JULY 1958

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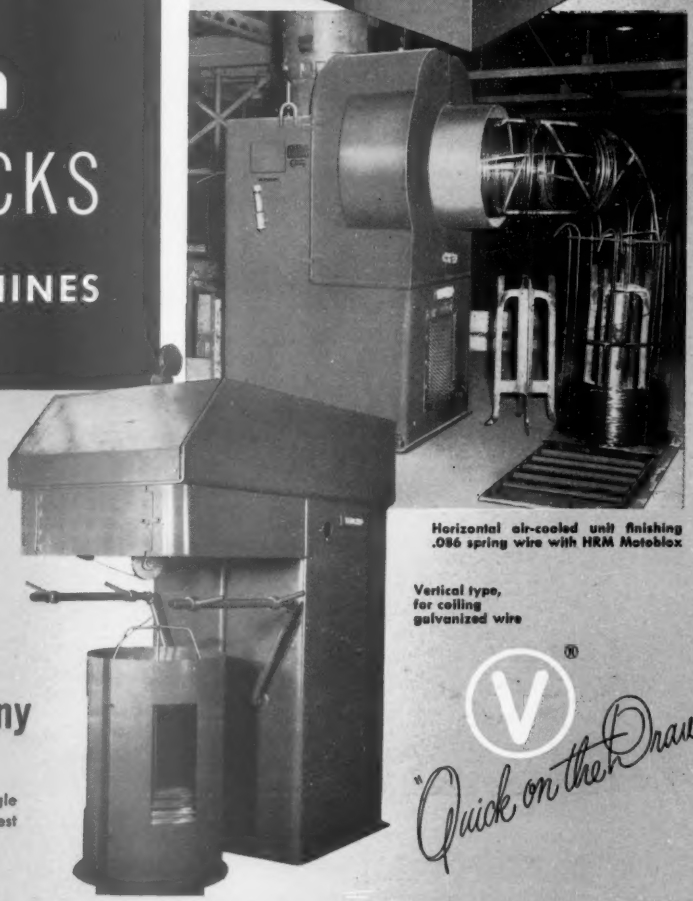
Horizontal attachment for Motoblox



Horizontal air-cooled unit finishing .086 spring wire with HRM Motoblox

Vertical type, for coiling galvanized wire

Available as integral attachments to new or existing drawing machines, or as separate floor-mounted units for use with drawing machines or as take-ups in processing lines, Vaughn Stationary Blocks permit continuous operation for production of coils of any size up to the largest bundles. Complete details on the many models of Vaughn Stationary Blocks in both horizontal and vertical types—for drawing, coiling, or both—will be provided promptly on request.

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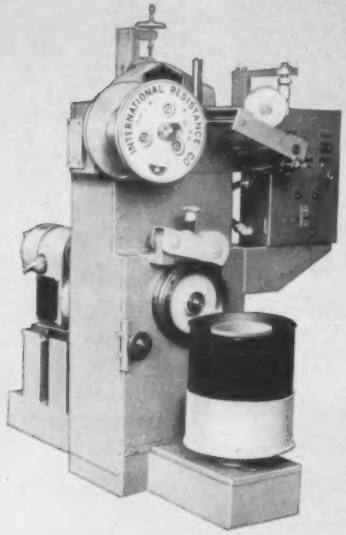

- Combination drum or spool take-up and rewinder.
- Shown for single wire.
- Adjustable for tension, pitch and amplitude of traverse.
- 12" spool shown. 30 to 150 lb. drums.

MODEL C-100 TAKE-UP

- Shown with single drive mounting to 16 wires .008" to .051"
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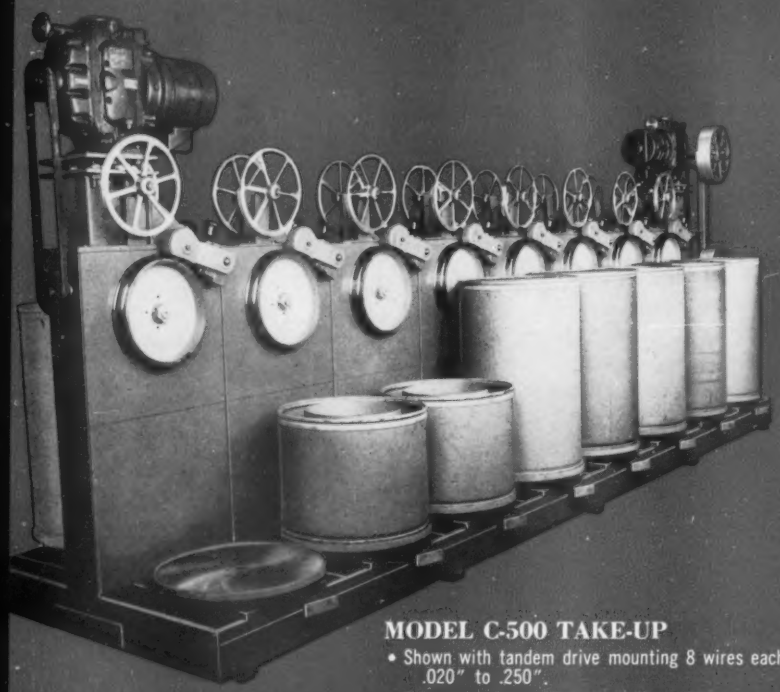

MODEL C-500 TAKE-UP

- Shown with tandem drive mounting 8 wires each side .020" to .250".
- Galvanizing, patenting, enameling, etc.
- Drum or adapter weights 200 to 1,000 lbs.

MODEL 138-A DRAW BLOCK

- Single draft wires .016" to .375"
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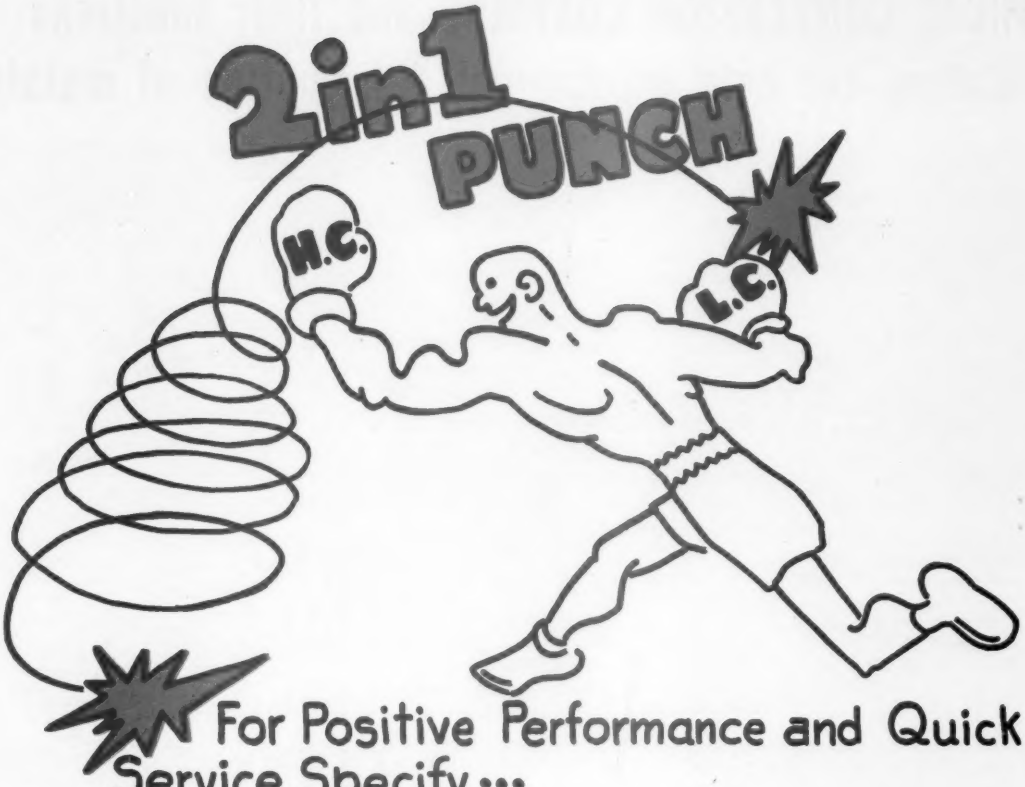

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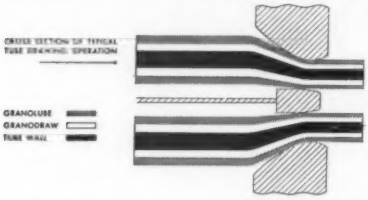
CHEMICAL CONVERSION COATINGS and their functions in facilitating the cold mechanical deformation of metals

By ARTHUR DAHL, Product Development Dept., AMERICAN CHEMICAL PAINT COMPANY

When used to facilitate the cold mechanical deformation of metals (in drawing, extrusion, stamping, cold heading, necking, and upsetting operations) chemical conversion coatings in conjunction with suitable lubricants perform three important functions. One, they prevent metal-to-metal contact between work and tool. Two, they prevent galling and seizing. Three, they protect stock indefinitely, permitting the storage of in-process work at any stage of production, without danger of corrosion damage.



Characteristic of the tightly bound, highly absorptive, crystalline coating formed by the processes is the ability of the coating to retain lubricity throughout forming operations when treated with a suitable lubricant. This offers the following production advantages:

- **Higher degree of reduction**
- **Greater speed of draw**
- **Longer tool life**
- **Fewer process anneals and pickling**
- **Finer surface finish**
- **Cleaner mills**
- **Easier inspection of finished product**

Also of interest to production men is the exact duplication of coatings from batch to batch. And the processes are much simpler than other methods of coating metals—baths can be set up and running in less time than it takes to determine suitable coatings by other methods.

TYPES OF COATINGS AND THE METALS FOR WHICH THEY ARE DESIGNED

Zinc phosphate coatings for carbon steel. These coatings can be applied by either dip or spray systems.

Dip. ACP Granodraw No. 1 is typical of the dip process. The sequence includes precleaning, water rinse, pickling, water rinse, water rinse, Granodraw No. 1 solution, water rinse, and a hot neutralizing rinse. Surfaces to be treated must be free of oil, grease, rust and scale. The above sequence insures that they will be. And when metal is free of rust and scale, the pickling bath and two succeeding water rinses can be omitted. In either case, a lubricant like ACP Granolube or conventional lubricant must be applied prior to working the metal.

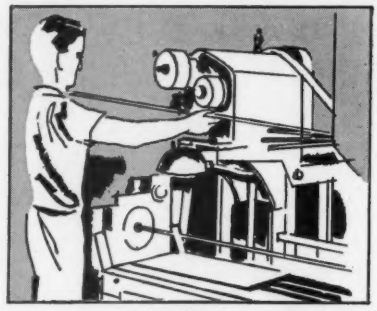
Spray. ACP Granodraw No. 4 is an example of the spray process. It usually requires 5-stage equipment and includes the following steps: precleaning, water rinse, Granodraw No. 4 solution, water rinse, lubricant. After chemical treatment, the work must be dried before forming.

Oxalate Coatings for the stainless steels and many of the high nickel alloys. These coatings are applied only by immersion process, and usually in a 5-stage system which includes an acid pickling or depassivating bath, a water rinse, the ACP Granodraw SS coating bath, a hot borax neutralizing rinse for wire stock, or a lubricating bath for tube stock. Since thorough activation of the metal surface is necessary to promote an adherent coating, the pickling and activating bath is an important stage in processing.

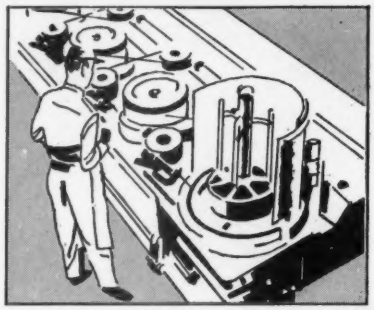
Fluoride-type coatings for zirconium and its alloys. Granodraw ZR is such a coating. It is applied in an immersion process which includes precleaning, water rinse, pickling, water rinse, Granodraw ZR solution, water rinse, drying or lubricating. It has been used primarily in the treatment of stock prior to wire drawing and tube drawing. Surfaces are cleaned of oil and grease by solvent degreasing or alkali cleaning. Pickling is required to provide a surface that is chemically and metallurgically receptive to the coating.

Strong alkali coatings for tantalum and amorphous phosphate coatings for aluminum. These two types of coatings are now in the development stage. Laboratory and field tests are being conducted, results are being evaluated, and modifications in chemical makeup and process sequence are being made to meet requirements. Several field tests, however, have indicated that they will do the same job for tantalum and aluminum processors as the other types of coatings have done for those working carbon steel, stainless steel, high-nickel alloy, and zirconium.

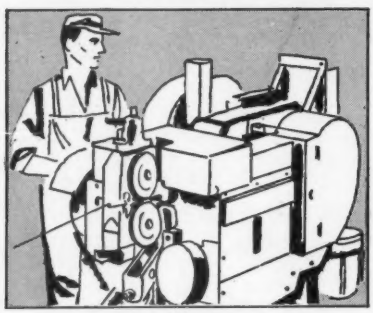
For more information write us at Ambler.



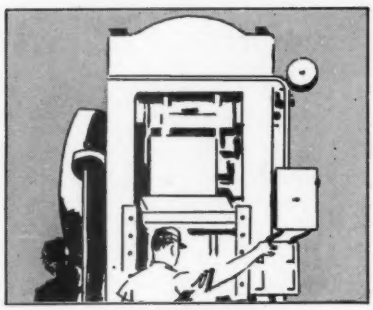
Tube Drawing



Wire Drawing



Cold Heading



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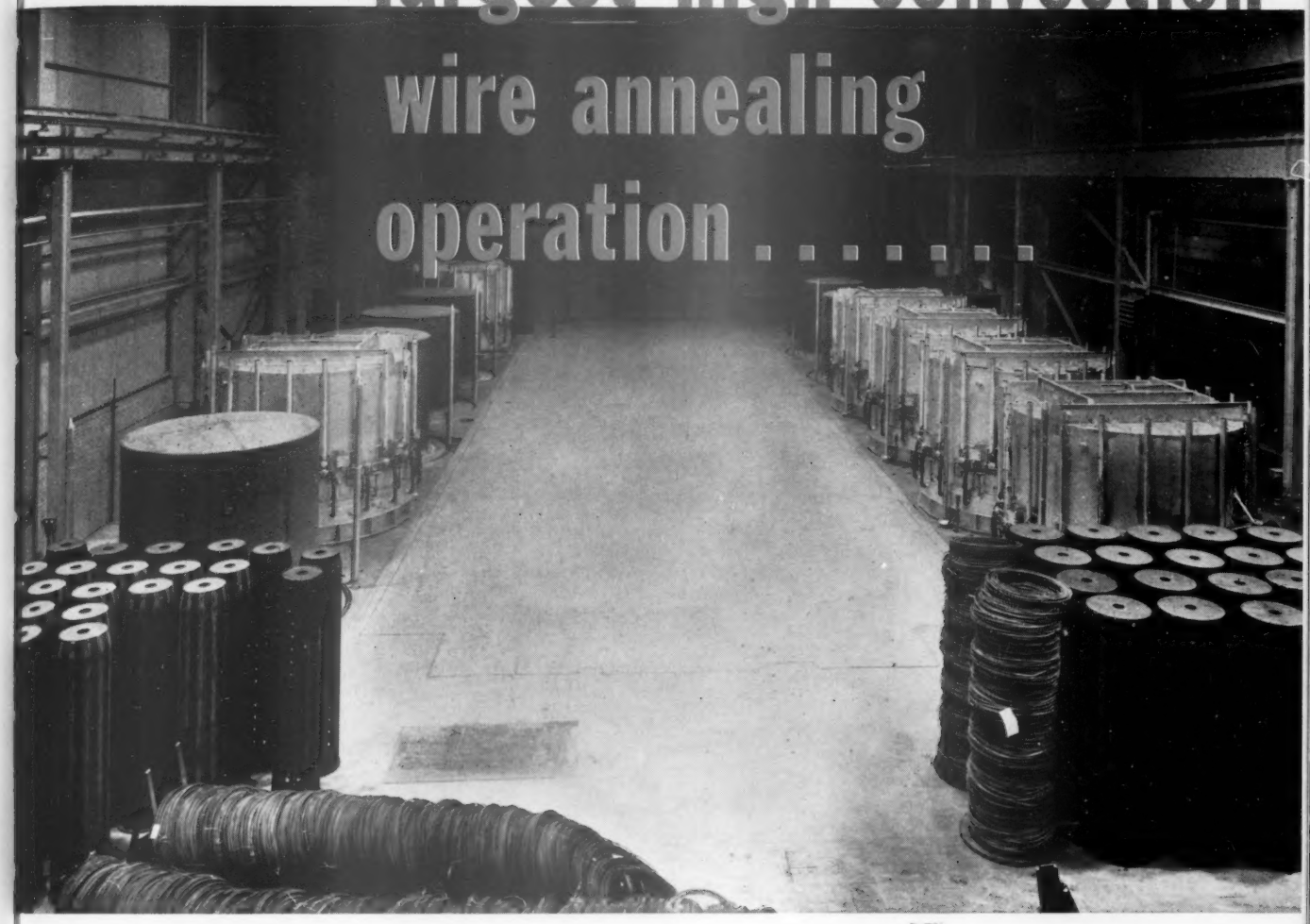

it's the largest installation of the largest furnaces

For the first time it is possible to anneal four large spindles of rod in a single charge in the efficient bell type high convection furnace.

Lee Wilson engineers recently set into operation six of the largest bell type radiant tube high convection furnaces ever built. With a charge diameter of 114" and a piling height of 108", these rod and wire coil annealing furnaces have a heat input of 5,000,000 BTU per hour per furnace.

The installation, made in one of the nation's largest wire and rod plants, consists of 6 furnaces and 12 annealing bases with 25 HP fan drives. The newest type of spider and coil loading and stripping machine is used to load the coils on the bases.

If you're considering new annealing equipment, make certain you keep up with competition—get the facts on this new Lee Wilson furnace.

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MAKE THE BEST METALS BETTER

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 33 July, 1958 No. 7

Designated as Official Publication By The Wire Association

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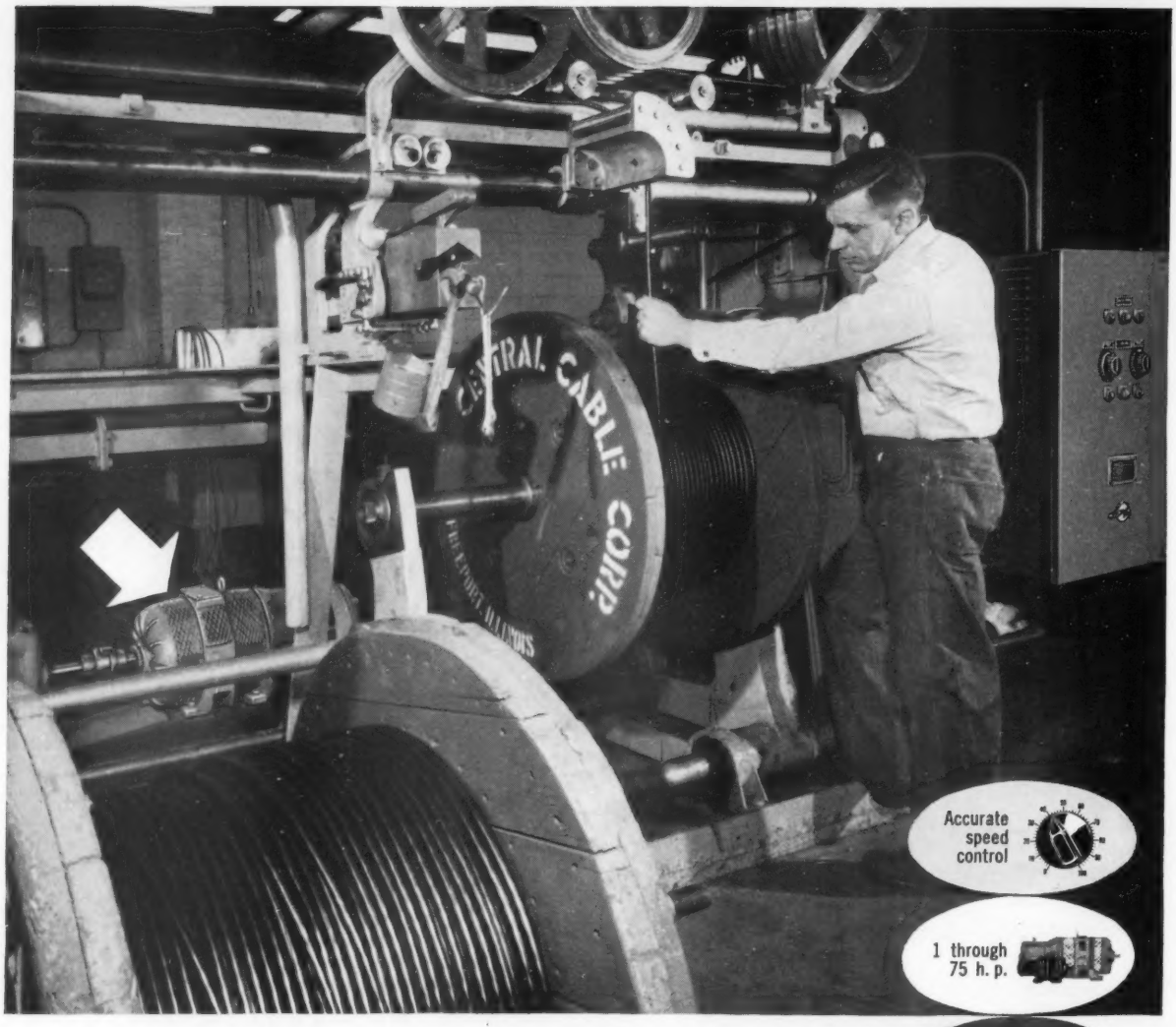

How to get higher wire production at lower cost:

Louis Allis provides dependable A. C. adjustable speed drives for wire lines

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Louis Allis controls give you "one-dial" master speed control to assure proper synchronization between extruder, capstan, and take-up.

The proof lies in the many successful Louis Allis wire-processing installations. There's a Louis Allis sales engineer in your area who'll gladly give you their names, and who can give you expert advice on the correct drives for powering *your* wire line.

Contact your nearby Louis Allis District Office or write The Louis Allis Co., 451 East Stewart Street, Milwaukee 1, Wisconsin.

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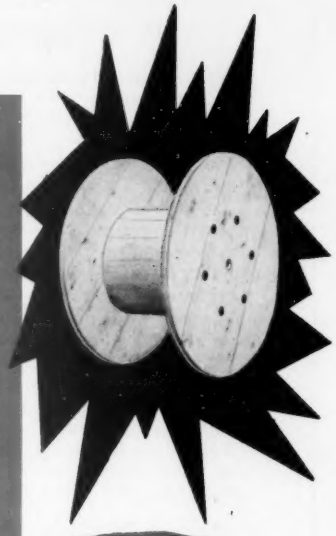

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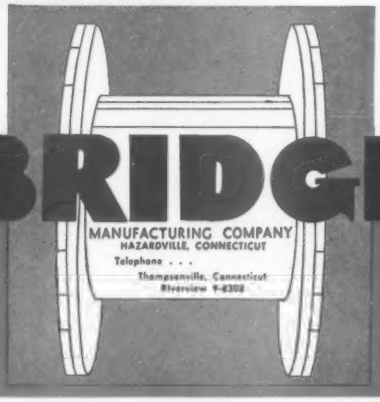

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Vol. III No. 1

POLYETHYLENE PROCESSING TIPS

PROCESSING CONDITIONS AFFECT STRESS-CRACK RESISTANCE OF POLYETHYLENE PRODUCTS

Most thermoplastic materials are subject in varying degrees to environmental stress-cracking . . . and polyethylene is no exception. Stress-crack failures may occur in polyethylene when the plastic is under high local stresses, either externally or internally applied, and in contact with soap, detergent or solvent.

Stress crack resistance depends on the resin used, and the processing conditions. The effect of polyethylene resin properties were discussed in the last issue of TIPS. This issue will be devoted to the effect of processing conditions.

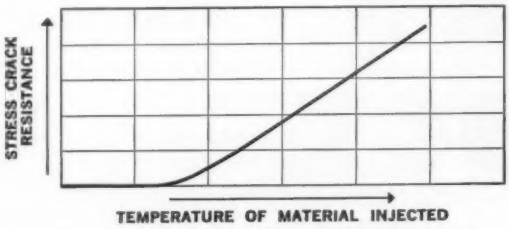
Apart from outside forces, there are, for a given polyethylene resin, two main causes of stress-cracking: locked-in stresses, and a high degree of molecular orientation. Locked-in stresses arise from uneven shrinkage during cooling. In molecular orientation, polyethylene molecules are comparable to iron filings in a magnetic field; they line up in force or stress patterns which, in effect, are stress concentrations along which fractures may occur.

Mold design affects stress cracking

To improve the stress-crack resistance of molded polyethylene, the molder should select his resin carefully on the basis of mold design, injection and mold temperatures, and, of course, the properties he wants in his end product.

Here, for example, is one way in which mold design can influence the choice of a resin: It is *generally* true that resins of higher molecular weight have relatively high stress-crack resistance. But in deep-draw molded items, or those with large cross-sections, resins of low molecular weight often yield a product with better stress-crack properties. This is because resins of low molecular weight—and hence, lower viscosity—permit the mold to fill more quickly. Under these conditions the material cools at a more uniform rate and fewer internal stresses are created.

Different flow rates, due to abrupt changes in mold cross-section or to sharp corners, may create points of stress concentration. These cannot always be eliminated, since every design is a compromise between mold engineering and product design.

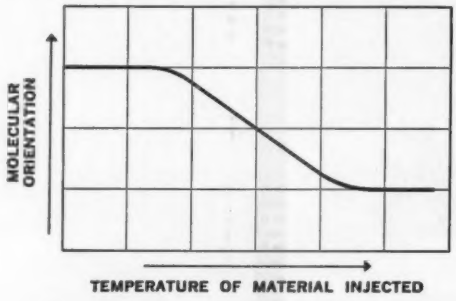


Stress crack resistance increases with higher stock temperatures in injection molding.

How Cold the Mold?

Higher production rates, made possible by running a cold mold, may be offset by a high incidence of stress-crack failures due to molecular orientation. This difficulty may be minimized by using a resin with the right flow properties—always bearing in mind that a practical compromise must be made with other desired end properties. Molecular orientation occurs when the hot resin comes in contact with the relatively cool walls of the mold. The outer surface of the stream cools faster than the interior and tends to slow down, while the material nearer the center flows unimpeded. The molecules tend to line up in the direction of flow.

This difference in cooling rates between the material at the periphery of the stream and its center also sets up internal stresses which induce stress-crack failures.



Molecular orientation is decreased with higher stock temperatures.

Mold Release Agents have some effect

Mold release agents may be of some benefit, as they tend to reduce the "drag" effect. However, caution must be used in their selection, since certain materials may induce stress cracking.

Compromise is often necessary

While no simple answer exists to the problem of stress-cracking in polyethylene products, resistance can usually be brought to a satisfactory level by choosing the best resin, making adjustments in molding temperatures, cooling rates and mold design. Since certain compromises must always be made, in selecting a resin and in processing techniques, processors can frequently use the services of a resin specialist. U.S.I.'s Technical Service Engineers are ready to discuss your processing problems, and to help in every way to solve them.

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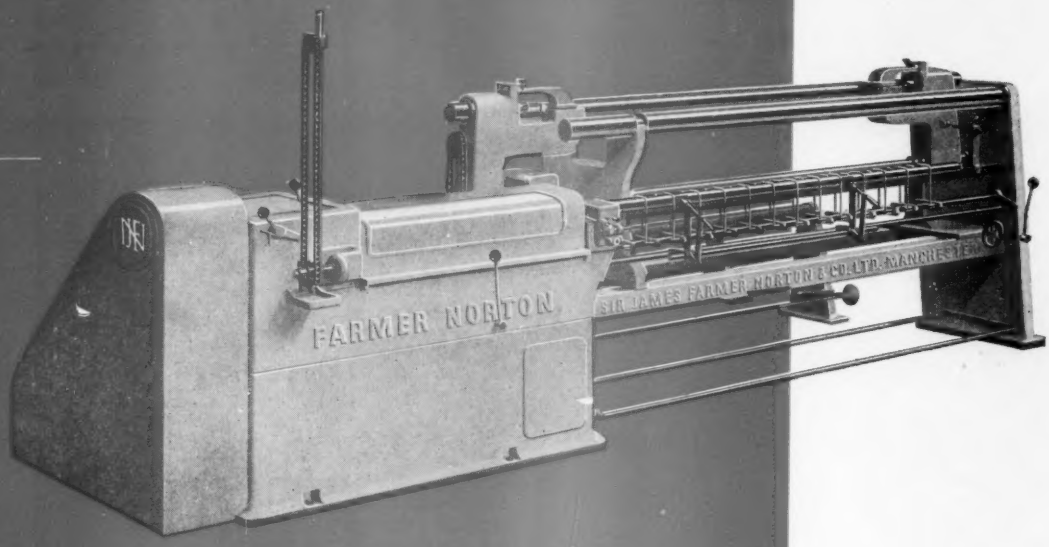

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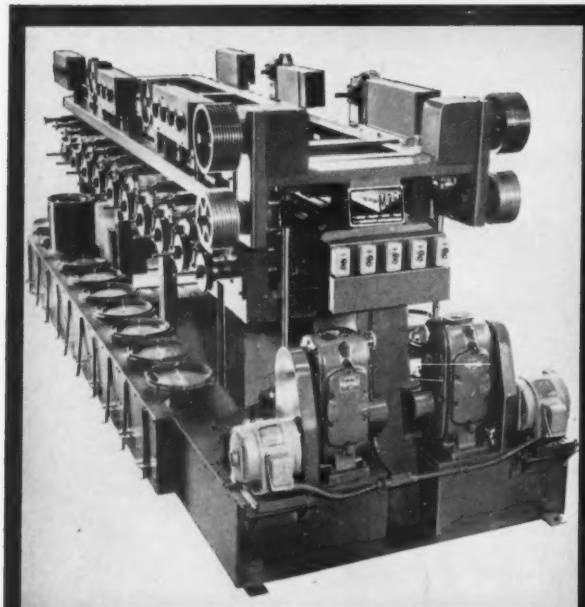
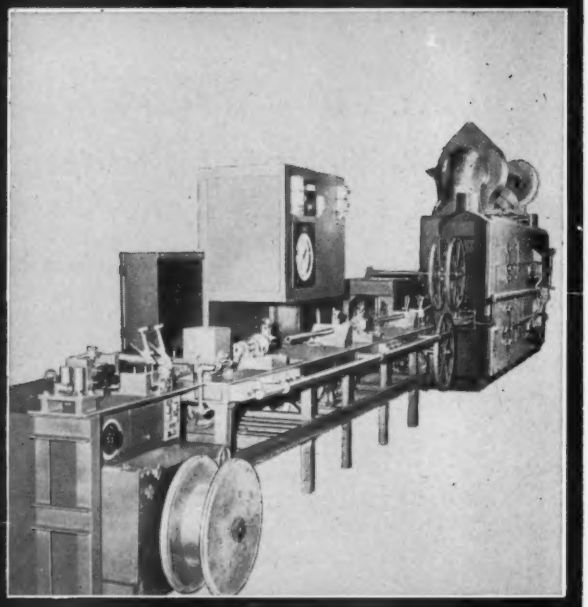


New Reel-R-Drum Packer handles two wire sizes simultaneously at different speeds through the same process.

MOCO's new Reel-R-Drum Packer is setting production records in forward-looking companies. This versatile unit has a speed range from 20 to 120 feet per minute. You can produce two wire sizes simultaneously through the same process at different speeds. Handling wire sizes ranging from .0089" to .025" in diameter, this MOCO Reel-R-Drum packages annealed copper magnet wire on different reels or in nominal 100 lb. capacity Payoffpak Drums, or both simultaneously. This versatile unit is built for tandem operation with a high speed MOCO type "C" wire enameling machine.

New MOCO Machine applies 2 servings of glass or yarn and 4 coats of baked insulating varnish

Satisfied users acclaim this new insulating, impregnating and varnish baking machine as a completely revolutionary development in the field of wire enameling. It is capable of turning out large quantities of heavy rounds and rectangulars (up to 150 M. Sq. Mls. Cross Sectional Area), baking on 4 coats of insulating varnish and applying two servings of glass or textile yarns . . . simultaneously! MOCO's revolutionary Rapid-Cool Oven lets you stop production without damage to wire in the oven. Return to full production in a matter of seconds because of the rapid rise of the temperature inside this MOCO Tunnel Oven.



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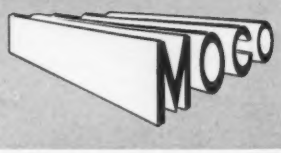


Coulter & McKenzie D-PAKer shown above

EASY LOADING • EASY DISPENSING • EASY STACKING

Forget about the time and trouble involved in splitting, tying and wrapping wire! Continental's Payoffpak accommodates up to 100 pounds of fine wire as fast as it's drawn or annealed. This is the most practical—and most economical—way to pack, ship, store and dispense fine wire, ferrous or nonferrous. Superbly lithographed by Continental to do a real selling job for you, Payoffpaks are economically priced for one-time use. Call or write Continental *today*.

CONTINENTAL CAN COMPANY

Eastern Division: 100 E. 42nd St., New York 17
Central Division: 135 So. La Salle St., Chicago 3
Pacific Division: Russ Building, San Francisco 4

Payoffpak has a sturdy bail, smooth slick interior, and necked-in bottom for secure stacking. No need of reels or wide range of block sizes in filling . . . longer length of continuous strand means reduced downtime for your customers.

EITHER LUG OR RING SEAL TYPE CLOSURE PROVIDES TRUE AIRTIGHT SEAL!

J&L extra clean, smooth, bright wire in .306" diameter is used in this sturdy motor mount by E. H. Titchener & Company.

"Wire enhances motor mount appearance, dissipates noise"

... states wire products manufacturer

"The J&L wire we use in this motor mount for a large air conditioner has a bright, clean and smooth finish so necessary for high quality plating work.

"It also meets our rigid physical and welding quality specifications," reports Mr. Paul Titchener, president of E. H. Titchener & Company, Binghamton, New York, manufacturers of quality wire goods since 1886.

"This modern mount design takes advantage of the natural resiliency of wire construction. The mount weighs only 13 pounds, provides free flow of air, minimizes vibrations," according to Mr. Titchener.

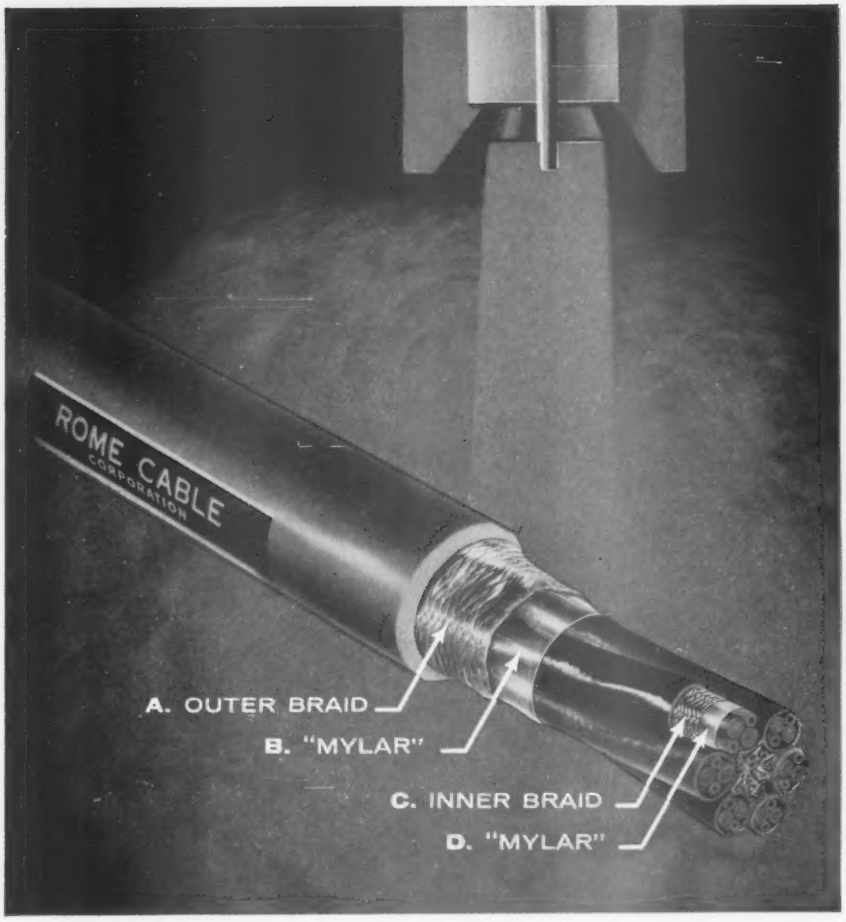
J&L manufacturer's wire has a superior quality due to close control in every phase of production from ore mine to finished product.

Next time you order wire, call your J&L representative for a recommendation on the exact steel wire for your specific job. Or write direct to Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J&L STEEL

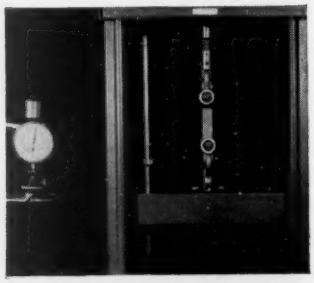
Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

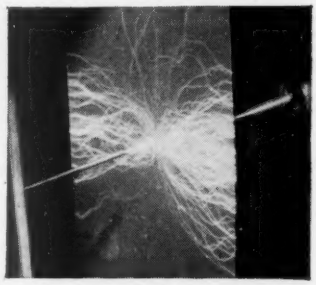


PROPERTIES OF "MYLAR"

"Mylar" offers a unique combination of properties that may help you improve performance and lower costs of *your* product. Here are two of the many important properties for evaluation.



HIGH TENSILE STRENGTH. "Mylar" is strong and durable. Instron Tester shows an average strength of 20,000 psi. It's dimensionally stable . . . resists moisture.



HIGH DIELECTRIC STRENGTH. Average of 4,000 volts per mil . . . average power factor of 0.003 to 60 cycles . . . dielectric constant above 3.0 at 72°F., 1,000 cycles.

Rome Cable reports . . .

Du Pont Mylar® helps eliminate reject problem in manufacture of cable for "Titan" ICBM

PROBLEM: In designing its instrumentation cable for the "Titan" ICBM project, Rome Cable Corporation wanted a thin, abrasion-resistant tape to protect the insulated conductors from possible puncture by loose strands of the tin-copper braid (See C in illustration). They were also searching for a thin, heat-resistant core binder tape to prevent possible puncture from the outer braid (See A) during extrusion of the cable jacket.

SOLUTION: A tape of Du Pont "Mylar" polyester film for both applications (See B&D). Reason: "Mylar" has the desired balance of mechanical and electrical properties . . . it's tough, abrasion- and puncture-resistant, even in thin gauges. "Mylar" has a high melting point . . . runs well on existing machinery.

RESULTS: The two tapes of "Mylar" eliminated shorted cables due to puncture from loose strands of metal. Solving this problem has helped Rome Cable stabilize production, save money on time and materials and produce a cable that assures better performance and greater reliability in the ICBM.

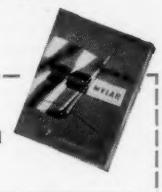
How can "Mylar" help you? Whether you manufacture heavy-duty cable or tiny capacitors, it will pay you to evaluate the combination of properties found only in "Mylar". And when figured on an area basis, this tough, thin polyester film will often *cost less* than your present insulating material. For more detailed information, send in coupon.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT
MYLAR®
POLYESTER FILM

"MYLAR" is Du Pont's registered trademark for its brand of polyester film.



E. I. du Pont de Nemours & Co. (Inc.)
Film Dept., Room EG-7, Nemours Bldg., Wilmington 98, Del.
Please send the new booklet listing properties, applications and types of "Mylar" polyester film available (MB-11).

Application_____
Name_____ Title_____
Company_____
Address_____
City_____ State_____

Are You Sure You Are Using the BEST Wire for Your Application?

• If your product involves the use of wire—PAGE asks—"*Can a new wire specification help make your product a better value?*" PAGE has helped many manufacturers to do so and—without increasing their manufacturing cost.

Here at PAGE we are in an ideal position to work with wire users in developing better wire for specific needs. PAGE is a specialty wire mill. Manufacturing wire has been our sole business since 1902.

Our engineering and production staffs regard wire as an important tool which can be designed and made to fill the exact requirements of our customers. Over the years PAGE has maintained a progressive attitude which has pioneered many "**firsts**" in the wire business. Among this list are items such as—

The first adoption of the patenting process in the U.S.
" " to use Tungsten Carbide Dies
" " commercial producer of Aluminized Wire
" " to produce and promote Stainless Steel Strand
" " Woven Wire Fence
" " Stainless Steel Fence
" " All-Aluminum Fence

Above all, PAGE is a dependable wire source. Many of our customers have grown with PAGE for nearly half a century. PAGE experience, talents and facilities are available to you at all times. We will be glad to work with your people in analyzing your wire needs, and if found advisable, in developing a new wire specification which may add to the usefulness and value of your own product.

PAGE - a Dependable Source for GENERAL WIRE

Partial list of PAGE General Wire materials, sections and special purpose wires:

MATERIALS	SECTIONS
Low Carbon	Rounds
High Carbon	Half Rounds
Low Alloy	Ovals... Flats
Stainless Steel	Half Ovals
Armco Ingot Iron	Squares
Aluminized	Special Shapes

SPECIAL PURPOSE WIRES

Aircraft	Signal Corps
Antenna	Spiral Binding
Armature Banding	Spring, Mechanical
Belt Hook	Spring, Upholstery
Broom	Stapling
Buckle	Stitching, Automotive
Button Fastening	Strand
Clip	Telephone
Core (ACSR)	Telegraph
Hairpin	Thermocouple
Lashing	Tire Bead
Lock Washer	Weaving
Safety, Lock	Welding
Shaped (see next column)	(see next column) —and others

PAGE - a Dependable Source for SHAPED WIRE

Many Grades • We furnish Shaped Wire in Low or High Carbon, Aluminized, Low Alloy or Stainless Steel, and in Armco Ingot Iron.

Many Sizes • Cross-section areas to and including .0625 sq. in. Flats and rectangles to 3/8" (width-thickness ratios to 6:1). Also rounds, half rounds, ovals, half ovals, squares, and specials.

Packaged Right • PAGE Shaped Wire—in standard or special coils or in random, exact or multiple lengths, is packaged as you want it: bare bundles, waterproof paper-wrapped, burlapped, boxes, cartons, Leverpaks—palletized on request.

***(SPECIAL NOTE** • We do not stock finished shapes We manufacture to customer specification)*

PAGE - a Dependable Source for HELPFUL LITERATURE

SHAPED WIRE • *Booklet DH1226*

Here is a 16-page booklet that is crammed full of useful information of value to every wire user. It tells you how to cut costs with PAGE Shaped Wire. It gives complete information on available grades of steel...tempers and finishes...size range, etc. It explains what information to include on inquiries and orders.

Also, **Booklet DH1226** contains page after page of useful standard tables, among which are:

- **Mensuration Factors • Carbon and Alloy Steel Weights**
- **How to Calculate Areas of Common Shapes**
- **Physical Properties of Steel Wire**
- **Decimal Equivalents • and many other useful tables**

You will find this booklet of great value.
Write our Monessen, Pa., office for **Booklet DH1226** today!

"ACCO ALUMINIZED" WIRE

Folder DH537 • You will want the complete facts on the amazing new "ACCO ALUMINIZED" wire—the wire that combines the strength of steel with the corrosion-resistance of aluminum. **Folder DH537** explains how this revolutionary new wire provides double protection...tells how its unusual physical properties make it superior for almost endless regular and special wire applications. "ACCO ALUMINIZED" wire is an exclusive PAGE product.

Write our Monessen, Pa., office for Booklet DH537

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

FABRICATE PARTS

easier, faster, better with

UNITED WIRE

When specs are tough, requirements rigid, savings essential, fabricate your parts with United Wire . . . aluminum, brass and copper alloys including 10-12-18% nickel silver. Here are the big important things you'll find in United Wire:

- Commercially bright — reduces finishing cost after forming.
- Tolerances — drawn or shaped to your most exacting standards.
- Temper — uniform throughout, every order, every time.
- Uniform coils — for trouble free pay-off.
- Size and shape — available in most sizes and shapes — round, square, flat and half-round.

Your "Wire Forms" can be fabricated easier and better at high speed production with low or no scrap loss by using "United" round or shaped wire.

Permanently United

UNITED WIRE
AND SUPPLY CORPORATION

PROVIDENCE 7, RHODE ISLAND

ALUMINUM, BRASS, COPPER WIRE AND TUBE - BRAZING ALLOYS AND FLUXES

for longer die life SUPERIOR TUBE COMPANY finishes with HYPREZ

HYPREZ
DIAMOND COMPOUNDS
for flawless lapping and polishing

In the Norristown, Pa., plant of Superior Tube Company, many hundreds of high-precision drawing dies must be finished and constantly maintained for maximum production.

Superior has found that long die life and top performance result from the use of Hyprez. These compounds comprise diamond particles of exact grading and concentration in a vehicle that assures permanent suspension and maximum finishing action. Hyprez Diamond Compounds are available in a complete range of grades from coarsest to finest.

From roughing to polishing, Hyprez Diamond Compounds produce finer finishes faster.

To finish any contour or detail, the Di-Profiler saves hours of expensive hand labor.

Di-Profiler
RECIPROCATING HAND MACHINE
saves time on detail and irregular surfaces

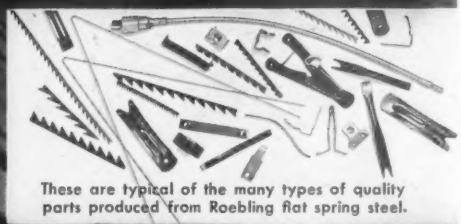
At Superior Tube Company, as well as in die, mold and tool shops throughout the country, the Di-Profiler has demonstrated important cost reductions in cutting, lapping and polishing operations on regular or irregular dies. This machine saves tedious hours of manual labor, especially on curved or fine detail jobs.

A variable stroke of 0 to 6 mm. (¼"), at a controllable speed of 0 to 100 per second—together with a complete assortment of cutters, files, discs, points, burrs, and scrapers—offer a versatility that makes the Di-Profiler economical for every type of precision job.

Ask for free demonstration or Technical Bulletin No. HDW-78

ENGIS EQUIPMENT COMPANY

431 SOUTH DEARBORN ST. • CHICAGO 5, ILL.



These are typical of the many types of quality parts produced from Roebling flat spring steel.

Speaking of Records

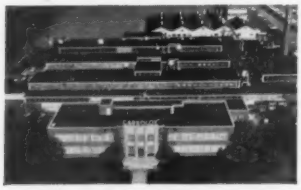
. . . *our* records show that when a manufacturer once discovers the exceptional and uniform quality of Roebling flat spring steel, he becomes a permanent Roebling customer.

Your records for faster production and lower costs can be improved, in large measure, by Roebling's strict attention to supplying you with the finest flat spring steel available. When you need flat spring steel, specify Roebling. Write Wire and Cold Rolled Steel Products Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities • Subsidiary of The Colorado Fuel and Iron Corporation

Roebling... Your Product is Better for it



Regional Die Center,
11177 E. 8 Mile Road, Detroit 32, Mich.
— headquarters for the
Metallurgical Products Department

Regional Die Center,
704 Second Ave.,
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Regional Die Center,
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Fastest Delivery!

NOW 7

REGIONAL SOURCES OF CARBOLOY® DIE PRODUCTS

Complete stocks of standard dies . . . rapid fabrication and refinishing service

This network of seven Carboloy Die Centers, Die Agents, and Metal Shops brings you everything you need in carbides — faster than ever before possible.

Standard Carboloy Die Products are stocked for fast delivery in Chicago, Detroit, Los Angeles, Philadelphia, and Pittsburgh.

Special Carbide Shapes can be fabricated and finished to your specifications by Carboloy Die Agents in Chicago and Philadelphia. Special cored nibs can be rushed to you from the Eastern Metal Shop in Kenilworth, N. J., and the new Midwestern Metal Shop in Chicago.

Die Refinishing and Technical Service are offered in Detroit, Chicago, Philadelphia, and Pittsburgh. For your copy of the new Carboloy Die Engineering Manual write: *Metallurgical Products Department of General Electric Company, 11171 E. 8 Mile Road, Detroit 32, Michigan.*

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CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

Naugatuck PARACRIL OZO

The oil-resistant, ozone-resistant nitrile rubber

Now! lasting **COLORS** in rubber wire jackets

A development of Naugatuck research makes it possible to combine in a vulcanized rubber wire jacket all these properties:

- Excellent resistance to ozone and outdoor "weathering"
- Outstanding heat resistance
- High abrasion resistance
- Excellent oil, grease and chemical resistance
- Fast CV extrusion

...**PLUS PERMANENT BRIGHT COLORS**

In addition to the suggested uses, you will think of dozens of other applications where wire jacketing with all these properties can serve either an aesthetic or utilitarian purpose.

One of Naugatuck's technical representatives will be happy to discuss with any prospective user the formulation of the Paracril® Ozo compound which makes possible this combination of properties... not only in wire jacketing but also in shoe soles, hose jackets, weather stripping and other vulcanized rubber products.

Naugatuck Chemical

Division of United States Rubber Company 741P Elm Street Naugatuck, Connecticut

Rubber Chemicals · Synthetic Rubber · Plastics · Agricultural Chemicals · Reclaimed Rubber · Latices · CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario · CABLE: Rubexport, N.Y.

The machine illustrated is a horizontal belt-type capstan unit, used in the electric cable industry. Such units can be used, along with extruder drive, to give linked tension control on complete plastic sheathing line.

...Generally speaking

If you can call engineering techniques involving high vacuum, hydraulics, pneumatics, electronics, physics and all the rest "general" engineering then that is what we are called! But generally we are regarded as very specialized engineers.

One field of activity where specialization is particularly required is equipment for the impregnation of paper insulated cables, turbo generator windings, etc. but another field in which we specialize, with almost universal application, is high vacuum pumps and equipment.

Yet another departure, but one again requiring a high degree of technical knowledge, is the manufacture of the huge "DANO" refuse disposal and composting plant. A revolutionary method of combining both sewage and refuse disposal economically and hygienically, supplying at the same time a marketable product, a highly organic compost.

Returning to the electrical industry we have recently designed and produced some outstanding equipment for the manufacture of domestic and telephone cable, including pay-off, extrusion, water troughing, measuring, capstan and take-up equipment. And when we say outstanding we really mean in operational range and performance.

Of course, our enthusiasm in engineering developments has not been disregarded. The evidence of our success can be measured by our continued expansion.

Why not write us for a copy of our "Summary of Products"? You may find that an enquiry is well worthwhile, and if warranted, we should be glad to discuss your matter personally. Do not hesitate to write or phone the Works or any of our district offices or agents.

General Engineering Company (Radcliffe) Limited

Station Works, Bury Road, Radcliffe, Lancs., England

Telephone: Radcliffe 2291 (4 lines) • *Telegrams: "General" Radcliffe, Manchester*

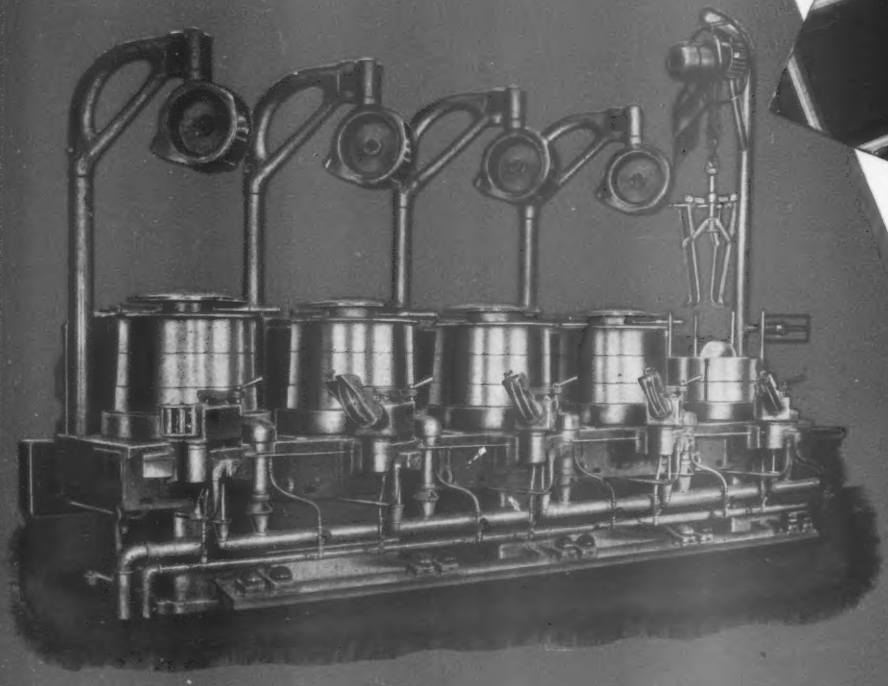
Represented in nearly every country in the world.

HERBORN

Non-Slip
Continuous

Wire Drawing Machines

For Low Carbon and
High Carbon Steel Wire



Please send your inquiries to

MASCHINENFABRIK HERBORN BERKENHOFF & DREBES A.-G. **HERBORN/DILLKREIS** GERMANY

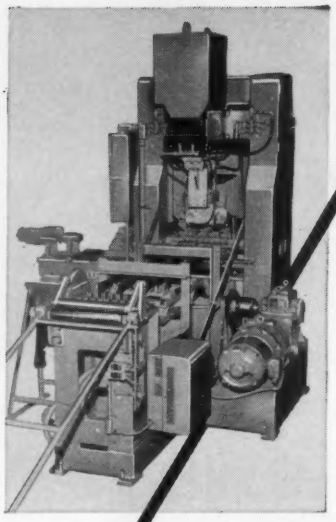
Sole Representative in the U. S. A.:

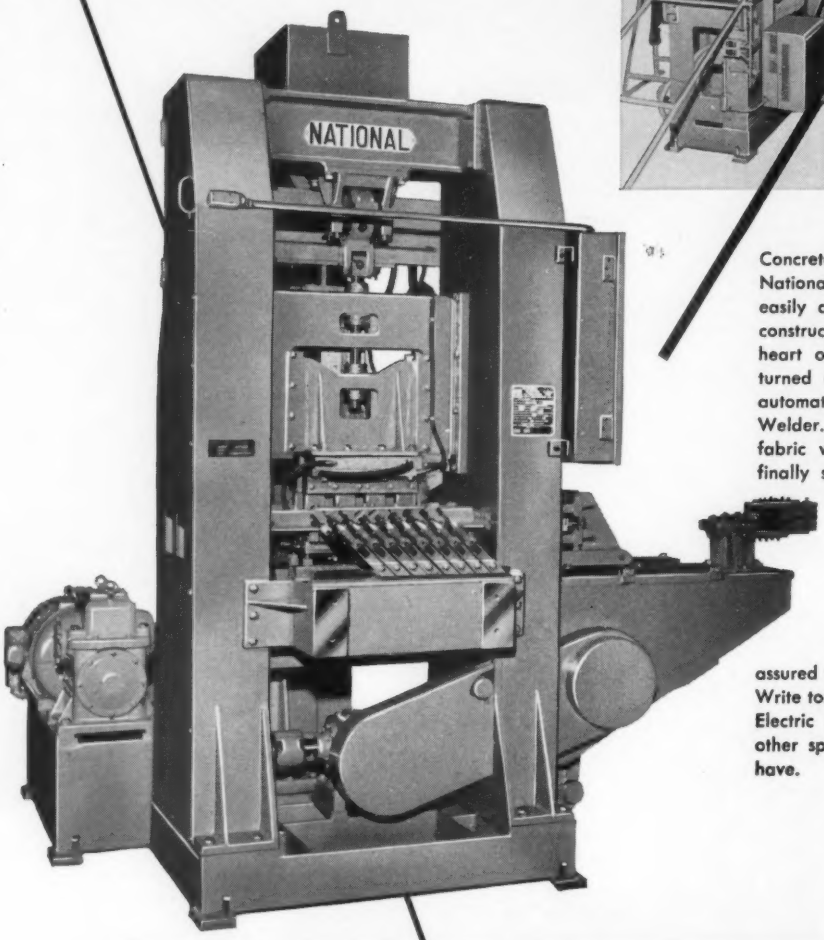
KURT ORBAN CO., Inc., 34 Exchange Place, JERSEY CITY 2, N. J.

NATIONAL

Electric machine

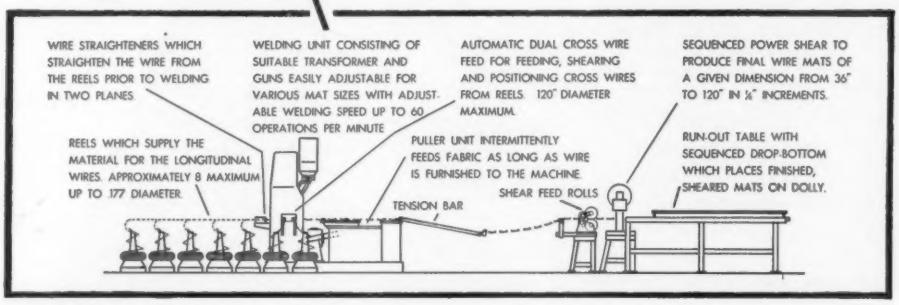
automatically feeds, welds, and stacks wire mesh for concrete plank





Concrete Plank, with wire mesh welded by a National Electric machine, is lightweight, strong, easily cut, and is solving many floor and roof construction problems in many installations. The heart of Concrete Planking, the wire mesh, is turned out at the rate of 60 feet per minute automatically by National Electric's Wire Fabric Welder. Starting with coils of line wire, the wire fabric welder first straightens, then welds and finally shears rectangular mats to the required size. After shearing, the top of the shear table divides and the mats fall on to a dolly, ready for use in Concrete Plank construction.

Profitable production, amazing savings in time, labor and cost-per-weld on any volume welding job, is assured with National Electric Automatic Welders. Write today for complete information on National Electric Automatic Wire Mesh Welders or any other special or standard welding job you may have.

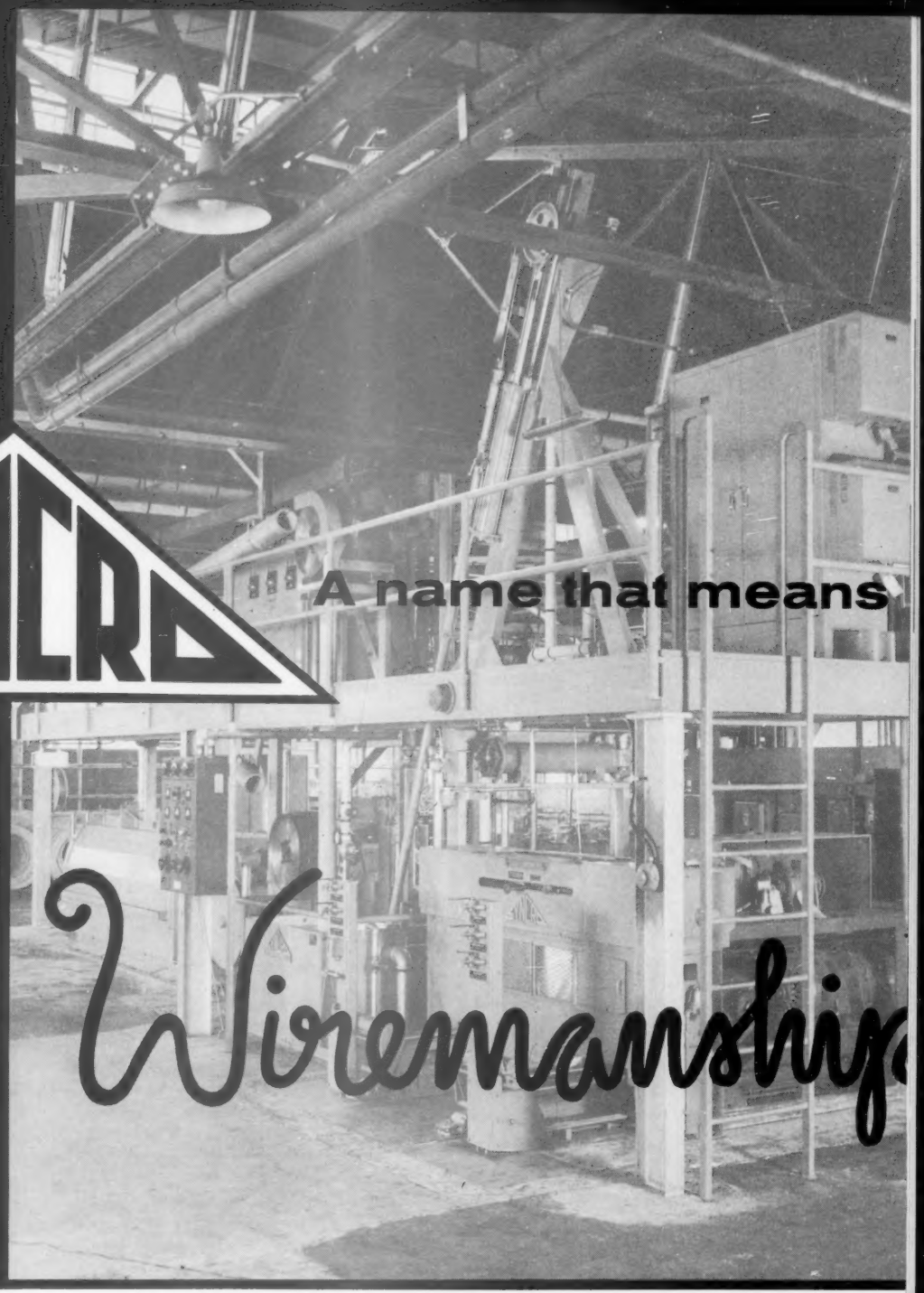

WIRE STRAIGHTENERS WHICH STRAIGHTEN THE WIRE FROM THE REELS PRIOR TO WELDING IN TWO PLANES.
WELDING UNIT CONSISTING OF SUITABLE TRANSFORMER AND GUNS EASILY ADJUSTABLE FOR VARIOUS MAT SIZES WITH ADJUSTABLE WELDING SPEED UP TO 60 OPERATIONS PER MINUTE
AUTOMATIC DUAL CROSS WIRE FEED FOR FEEDING, SHEARING AND POSITIONING CROSS WIRES FROM REELS. 120" DIAMETER MAXIMUM.
SEQUENCED POWER SHEAR TO PRODUCE FINAL WIRE MATS OF A GIVEN DIMENSION FROM 36" TO 120" IN ½" INCREMENTS.
REELS WHICH SUPPLY THE MATERIAL FOR THE LONGITUDINAL WIRES. APPROXIMATELY 8 MAXIMUM UP TO 177 DIAMETER.
PULLER UNIT INTERMITTENTLY FEEDS FABRIC AS LONG AS WIRE IS FURNISHED TO THE MACHINE.
RUN-OUT TABLE WITH SEQUENCED DROP-BOTTOM WHICH PLACES FINISHED, SHEARED MATS ON DOLLY.
SHEAR FEED ROLLS
TENSION BAR

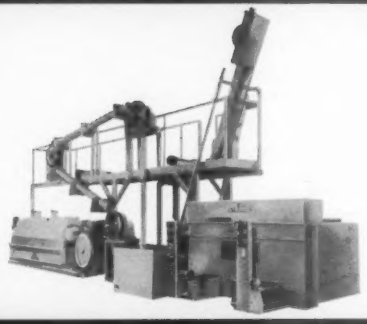
51

NATIONAL Electric welding machines co.

1880 N. TRUMBULL STREET
BAY CITY, MICHIGAN

25 YEARS EXPERIENCE DESIGNING AND BUILDING: SPECIAL & STANDARD • AIR • HYDRAULIC • MOTOR DRIVEN • SPOT • PROJECTION • SEAM • BUTT • FLASH • RESISTANCE WELDERS • PRODUCTION FIXTURES FOR ALL TYPES OF AUTOMATIC ARC WELDING.





*Syncro has a new word for the wire industry . . . it's Wiremanship. It means leadership in design and manufacture of superior wire drawing equipment. Syncro's Continureel presents a production line picture of Wiremanship in action. To the left Continureel is shown operating as part of a continuous automated method of wire drawing, annealing, and spooling at highest possible operating spee Continureel is a Syncro exclusive . . . And so is Wiremanship.

Better Machinery for the Wire Industry

SYNCRO MACHINE COMPANY

Perth Amboy, New Jersey, U.S.A.

affiliated company: WINGET SYNCRO Ltd. Rochester Kent, England

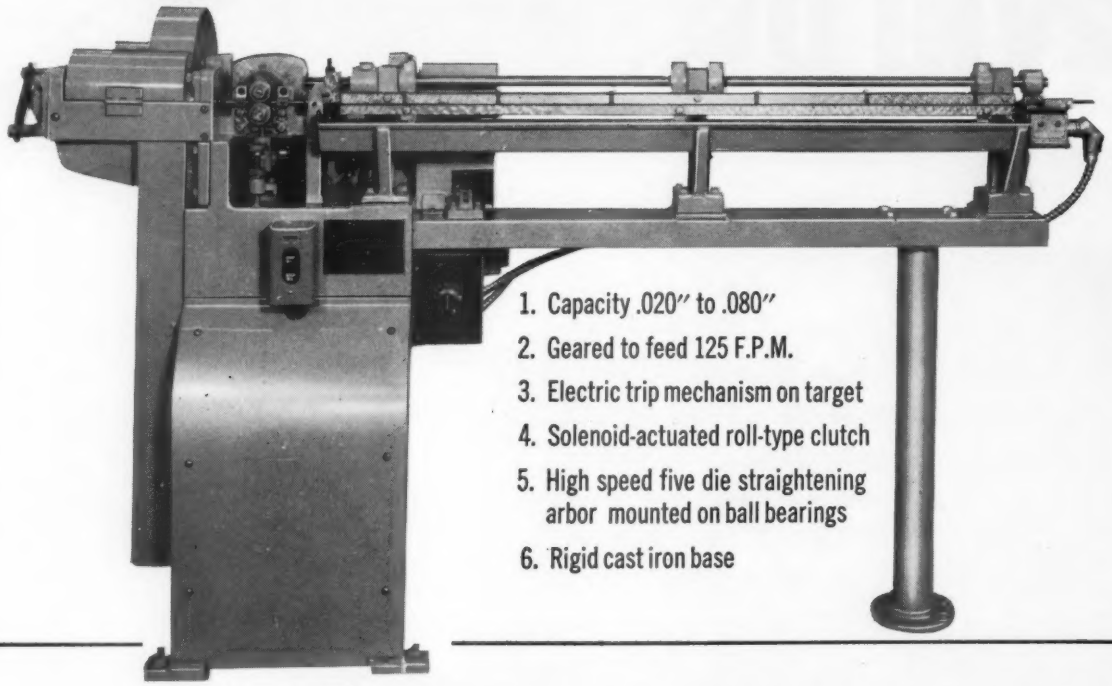
WIRE DRAWING MACHINES • DIE STRINGERS • CONTINUOUS ELECTRIC ANNEALERS • PAYOFFS • CAPSTANS • WIRE INSUL

HEAVY DUTY TAKEUPS • TAPERS • SPECIAL MACHINERY

Now High Speed Straightening and Cutting of Fine Wire

.020" to .080"

New SHUSTER MODEL A produces up to 12,000 pieces per hr.*



1. Capacity .020" to .080"
2. Geared to feed 125 F.P.M.
3. Electric trip mechanism on target
4. Solenoid-actuated roll-type clutch
5. High speed five die straightening arbor mounted on ball bearings
6. Rigid cast iron base

**12,000 pieces per hour based on straightening and cut-off of 6" lengths of .040" diameter basic bright wire. Applies to larger sizes also.*

The *New* Model A from SHUSTER, the *oldest* name in the trade, raises production sights for the most-used wire between .020" and .080" diameters. This *constant speed, electrically controlled* machine, with advanced engineering features, incorporates the same skill and care in manufacture that keep SHUSTERS performing at peak efficiency far beyond normal life expectancy.

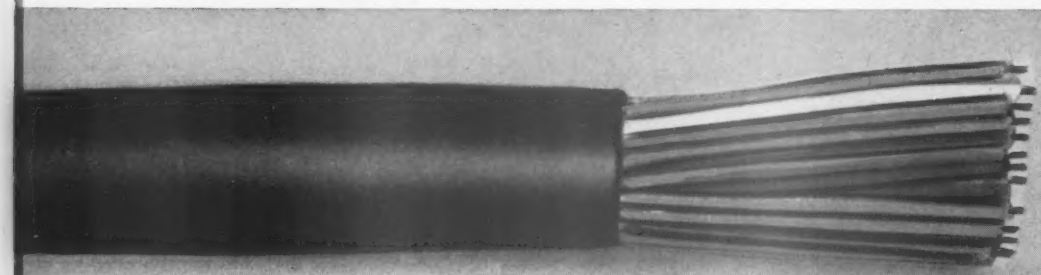
Users report their *New* '58 Model A High-Speed machines have already paid for themselves. Send us your wire straightening and cutting requirements from .020" to 11/16".

SHUSTER Since 1866

METTLER MACHINE TOOL, INC.

155 West Adeline Street • New Haven, Connecticut

THE MESSAGE IS: MONSANTO



OPALON 1101, "engineered" for primary insulation of switchboard cable by high resistance to cut-through, and excellent deformation resistance.

your source for "engineered" vinyl telephone insulation compounds

Communications wire and cable manufacturers like the "engineered" choice offered by the Monsanto Opalon series of vinyl compounds, designed and developed for individual application requirements.

For example: Opalon 1101, a semi-rigid vinyl compound for primary insulation of switchboard cable. Resistance to both cut-through and deformation: excellent. High gloss, smooth surface, great ease of extrusion, excellent heat stability and insulation properties, available in a broad range of colors.

Monsanto also offers a broad line of polyethylene insulating compounds. When you want a specific answer to an insulating problem, call in your local Monsanto representative. Write for complete technical data on Opalon vinyl compounds and polyethylene compounds to Monsanto Chemical Company, Plastics Division, Room 543, Springfield 2, Mass.

Monsanto®

OPALON: REG. U.S. PAT. OFF.

ASSORTED STEEL WIRE in ONE carload... from ONE source

From Armor Wire to Zig-Zag Wire, CF&I makes steel wire to meet thousands of specifications—packages it to meet any requirement—sells it by the coil or the carload.

You can simplify your purchasing by making CF&I your *source of supply*. Whether you need one coil of just one type of wire or a mixed carload of "assorted" wires, our newly enlarged and modernized wire mills and strategically located warehouses can get it to you—fast.

We supply high or low carbon steel wire—round, flat or shaped—in a wide variety of sizes, tempers, grades and finishes — in steel-strapped or paper-wrapped coils; on spools, reels, "spiders" (holding up to a 4000-lb. continuous length of wire) or in fibre drums. Let us know your requirements.

CF&I-WICKWIRE WIRE

THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso • Ft. Worth • Houston • Kansas City • Lincoln • Oklahoma City • Phoenix • Pueblo • Salt Lake City • Wichita
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • San Leandro • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia
CF&I OFFICES IN CANADA: Montreal • Toronto • **CANADIAN REPRESENTATIVES AT:** Calgary • Edmonton • Vancouver • Winnipeg

5757

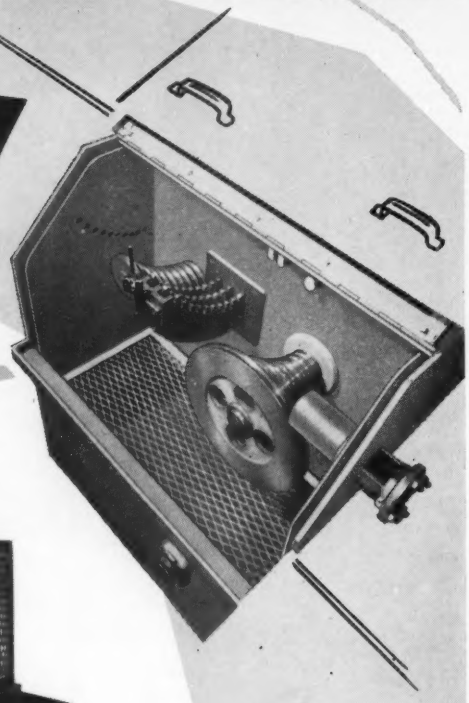
wire ENGINEERED

MODEL FW-II

FINE WIRE WET DRAW MACHINE

Completely self-contained
...Built-in Lubricant system

Welded steel construction
Finishing speed to 2200 F. P. M.
Enclosed gearing (in oil)
Direct drive (no belts)



Outside dry die box
A C Drive—2 to 1 speed range
Accumulative snarl boom
"Dynomatic" or D C drive
(infinitely variable)

- 8"—12" or 16" Blocks (water cooled optional)
- Individual machinable capstans (Carbide optional)
- Adjustable finishing die holder

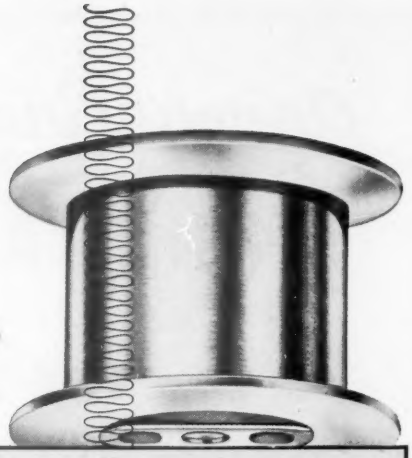
wire ENGINEERING ASSOCIATES, INC.

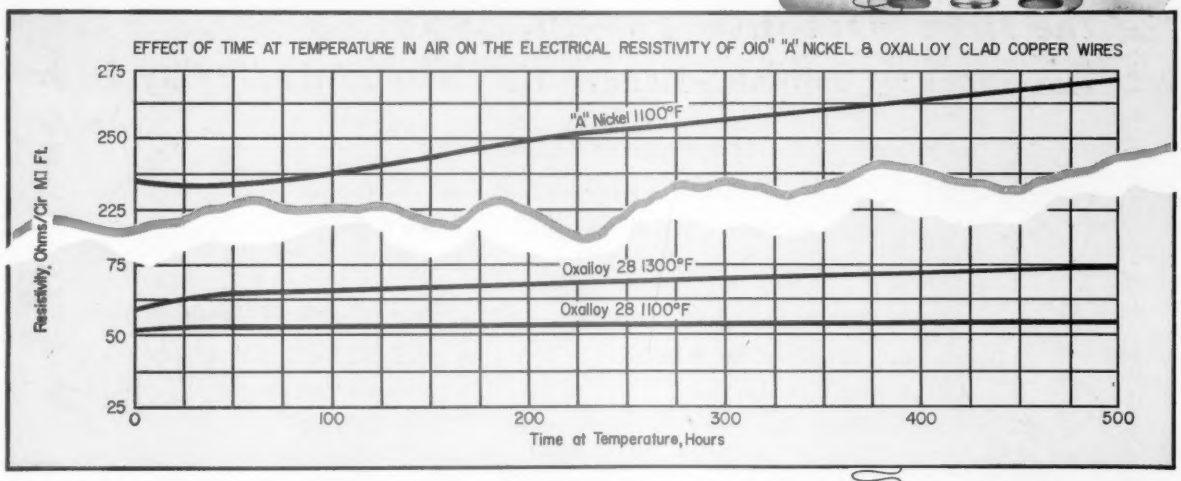
16130 VAN DRUNEN ROAD • SOUTH HOLLAND, ILLINOIS

Midwest Representative: Bronson & Bratton Inc., Chicago 32, Illinois

NEW

Sylvania Oxalloy* 28 Wire...





—nothing else is so stable, for so long, at such high temperatures

OXALLOY 28 is Sylvania's new copper wire clad 28% by weight with a chrome-iron alloy. This cladding provides excellent oxidation and corrosion-resistance at high temperatures, making OXALLOY 28 extremely reliable during prolonged exposure to temperatures as high as 1300° F.

If, in your wire application, high conductivity must be maintained for long periods of time—then OXALLOY 28 is meant for you. Compare the rate of change in resistivity of pure "A" nickel and Sylvania's new OXALLOY 28.

We would like to supply you with complete data on other properties of OXALLOY 28, Sylvania's new clad copper wire. Write to Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.

Sylvania is the only major wire supplier with complete facilities for both plating and cladding wire. This makes it possible to provide you with an experienced, objective recommendation as to whether a plated or a clad wire is best suited for your application.

In addition, Sylvania's Parts Division offers you a complete line of custom parts and components.

*Trade-mark

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LIGHTING • TELEVISION • RADIO • ELECTRONICS
PHOTOGRAPHY • CHEMISTRY-METALLURGY

PARTS DIVISION

Custom Molded Plastics
Custom Metal Stampings
Custom Welded Parts
Alloy, Clad, Plated Wire
Plated Metal Strip
Electronic Components
Fluorescent Components

Announcing the . . .

ANNUAL CONVENTION

OF

THE WIRE ASSOCIATION

The Dates: **October 13—16, 1958**

The Place: **Chalfonte - Hadden Hall Hotel, Atlantic City, N. J.**

The Program Committee

General Program Chairman

Raymond S. Worth, Mfg. Mgr., Wire Mills Div.
John A. Roebling's Sons Corp., Trenton, N. J.

Ferrous Program Chairman

Dartrey Lewis, Chief Eng., Res. & Dev.
John A. Roebling's Sons Corp.
Trenton, N. J.

Non-Ferrous Program Chairman

Hugo W. Biskeborn, Consultant
Salesville Heights
Lincoln, R. I.

The Program

For the Ferrous Division, seventeen technical papers have been secured, covering various phases of steel wire processing and manufacturing operations.

The Non-Ferrous Division presently has concluded arrangements for sixteen papers covering production problems in connection with bare and insulated power conductors and communication wire and cable. This will include many more papers of interest to electric wire and cable men than have been presented at any previous convention.

Plant visits to Roebling's steel wire plant in Roebling, N. J., and to Roebling's electric wire and cable plants in Trenton, N. J.

Many other program features will make the 1958 Convention the most important one yet held. Full details will be published at a later date.

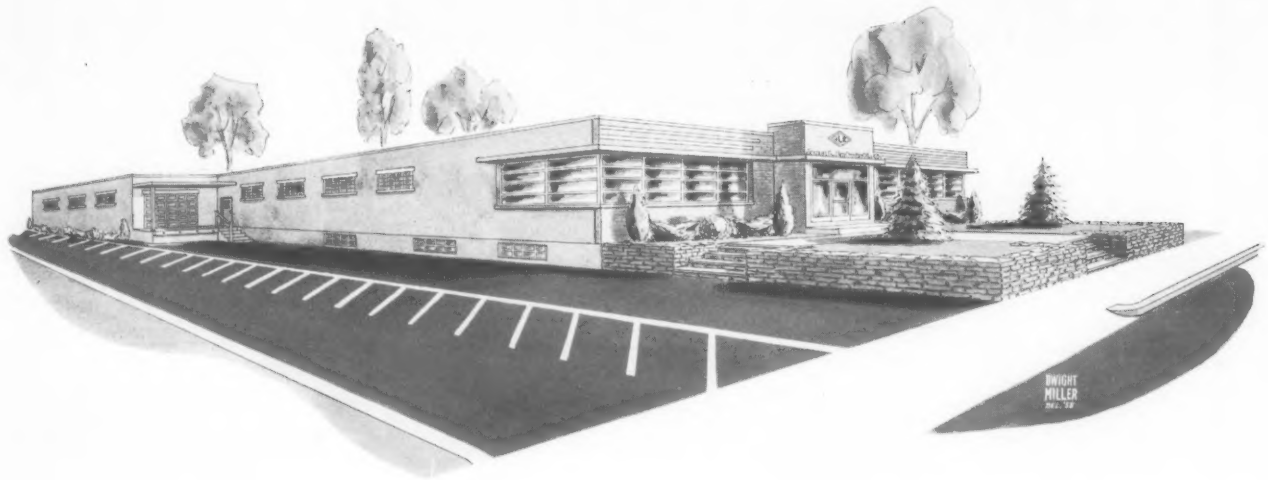
Meanwhile, make your plans to attend.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET **STAMFORD, CONN.**

THE "KNOW-HOW" OF 40 YEARS IS NOW AT HOME AT 100 GLEN ROAD...



TWENTY YEARS AGO,
The James L. Entwistle Company introduced a new principle and method for the Spark Testing of wire that has since become the standard of the World.

Now our new developments of "Controlled Power"* and Positive Electronic Fault Location* have made all previous methods obsolete.

From our recently completed, modern, air conditioned factory, we are now in a position to promptly supply the industry with all of our years-ahead equipment for the processing and handling of wire.

- A.C. AND D.C. "CONTROLLED POWER"* SPARK TESTERS
- COMPLETELY AUTOMATIC RE-REELER-SPARK TESTERS
- AUTOMATIC DOUBLE-HEAD COILER SPARK TESTERS
- PRINTING-TYPE FAULT AND REEL RECORDERS
- OPEN-SIDE MEASURING MACHINES
- SHAFTLESS TAKE-UPS
- PAY-OFF REEL STANDS
- BALL BEARING WORM TRAVERSES
- WIRE MARKING WHEELS, TYPE STRIPS AND INKS

Complete Patent Protection Applied For

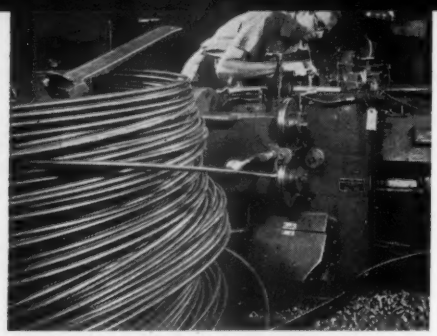
James L. Entwistle Co.

SPARKING THE WIRE INDUSTRY SINCE 1918 JLE

100 GLEN ROAD • CRANSTON 10, R. I., U.S.A.
MAILING ADDRESS, P.O. BOX 3674
CABLE "JALENCO" PROVIDENCE
PHONE HOPKINS 7-8411

ENGLAND
General Engineering Co.
(Radcliffe) Ltd.
Station Works - Bury Road
Radcliffe, Lancashire, England

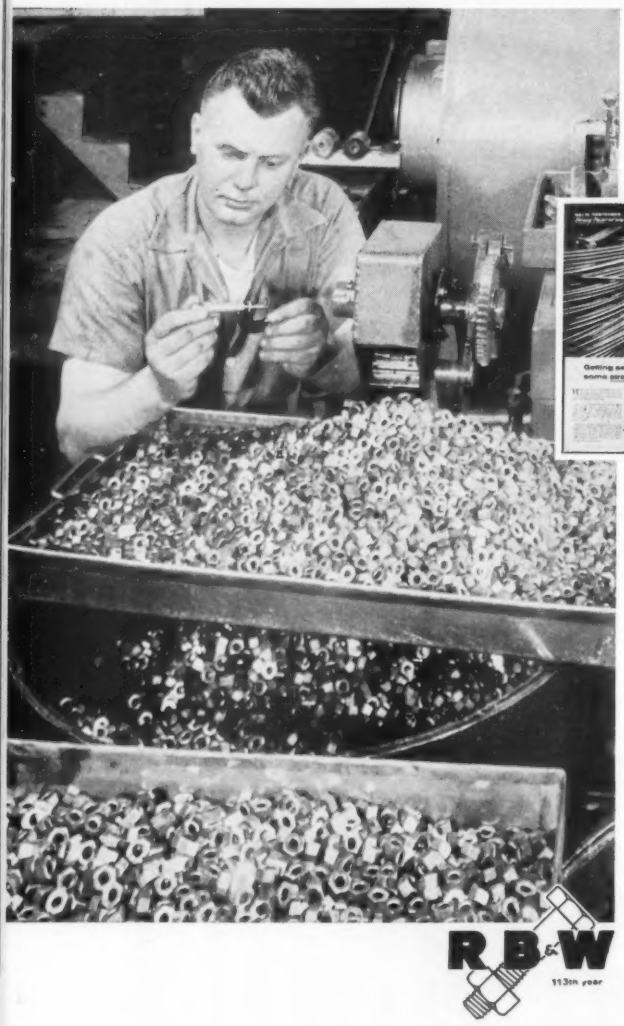
A REVOLUTIONARY NEW ELECTRODE UNIT WILL BE INTRODUCED IN THE AUGUST ISSUE!



This modern Cold Header forces wire drawn from Youngstown Rods to flow inside the dies. It spills out bolt or screw blanks by the thousands— every hour, all day long.

Accent on Excellence

Youngstown cold heading and scrapless nut quality rods and bars



Russell, Burdsall & Ward Bolt and Nut Company of Port Chester, N. Y. is one of the world's largest and best known fastener producers with plants at Coraopolis, Pa., Rock Falls, Ill., and Los Angeles, Calif. They stated in one of their recent advertisements:

"The cold heading method (an RB&W development that revolutionized bolt making) calls for use of uniform, high quality raw material. With constant quality control, RB&W makes sure our cold headers get the proper 'diet'."

Youngstown's Cold Heading and Scrapless Nut Quality Rods and Bars in coils answer RB&W's rigid requirements. They find them to be internally sound, uniform in both physical structure and chemical composition—as well as free from injurious seams and slivers, which cause rejects, reduced profits.

Wherever steel becomes a part of things *you* make, the high standards of Youngstown *quality*, the personal touch in Youngstown *service* will help you create products with an "accent on excellence".

QUALITY YOUNGSTOWN SERVICE

THE

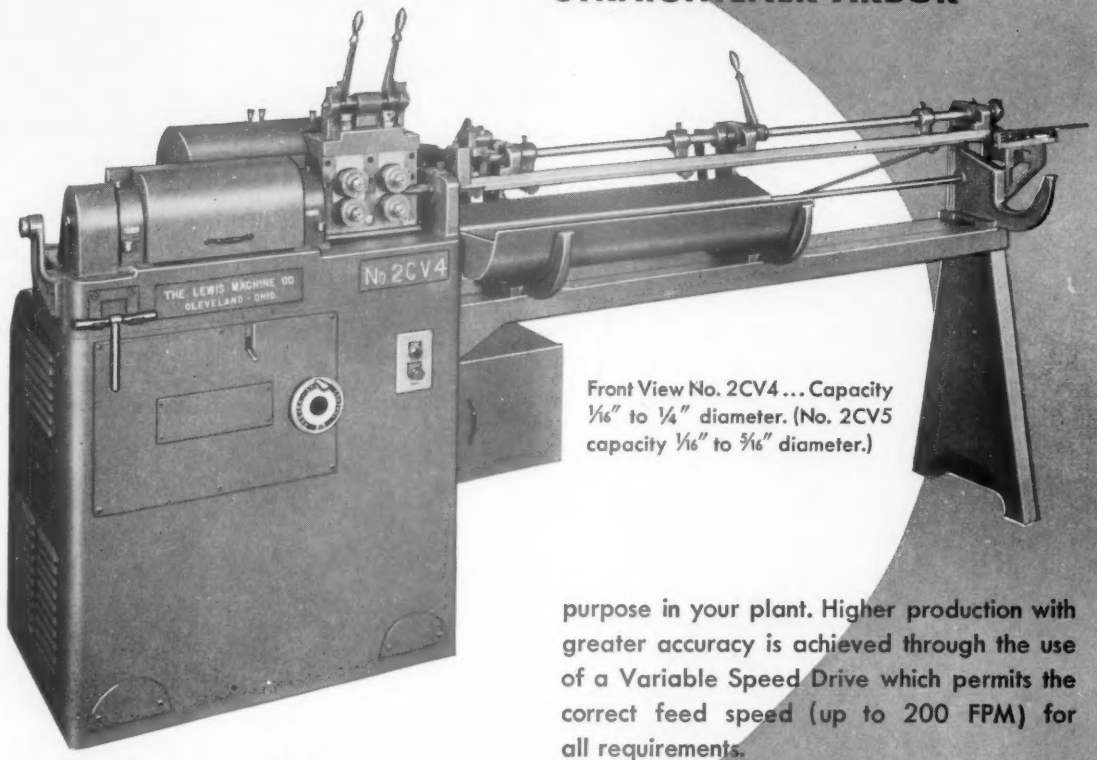
YOUNGSTOWN

SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel
Youngstown, Ohio

THE NEW **LEWIS** *Convertible**

AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINES WITH VARIABLE SPEED DRIVE AND DUAL-CENTER STRAIGHTENER ARBOR



Front View No. 2CV4 ... Capacity 1/16" to 1/4" diameter. (No. 2CV5 capacity 1/16" to 5/16" diameter.)

* The new Lewis No. 2CV series is equipped with our Dual-Center Rotary Straightener Arbor and can be quickly converted to handle shapes by installing our interchangeable Roll Straightener.

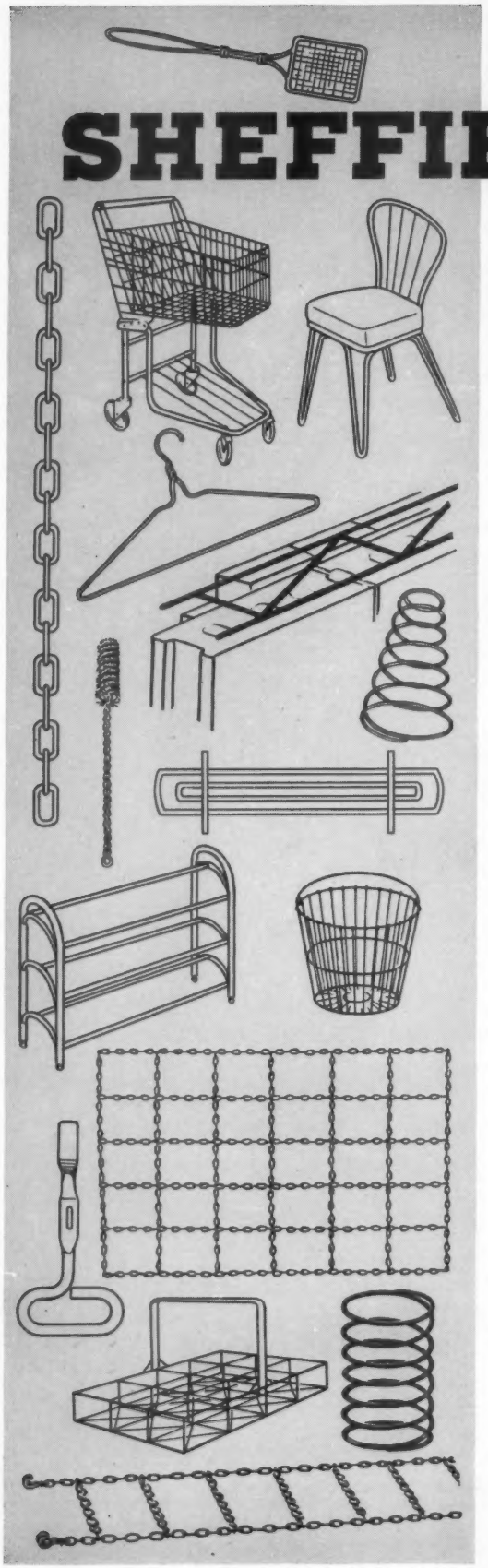
This convertible feature introduces a new flexibility in wire straightening and cutting operations . . . one machine can serve a double purpose in your plant. Higher production with greater accuracy is achieved through the use of a Variable Speed Drive which permits the correct feed speed (up to 200 FPM) for all requirements.

The outstanding feature of this series is the DUAL-CENTER STRAIGHTENER ARBOR (Pat. Pending) for round wire. This feature increases the range of the machine and makes it possible to precision straighten small diameters below the capacity of other machines.

Other models available to handle .012" to 1" diameter, as well as shapes.

THE LEWIS MACHINE COMPANY

3441 East 76th Street • Cleveland 27, Ohio • A Division of Curtis Mfg. Co.



Why manufacturers use

SHEFFIELD WIRE

in more than 2,000 quality products

Manufacturers and fabricators depend on Sheffield Wire for unvarying quality and accuracy in meeting their wire specifications. They are sure of getting the RIGHT wire—and getting it fast—because of Sheffield's advanced quality controls and strategic plant locations.

We're old hands at helping customers solve wire problems—with results that speed production, cut costs and improve products.

Let our metallurgists and wire specialists analyze your wire uses. We'll not only come up with the right wire for you, but also may be able to recommend more economical ordering units. This service is yours for the asking. Just call your nearest Sheffield office.

SHEFFIELD KONE PAK*

gives you in one continuous spool the equivalent of 2 to 40 ordinary coils of wire. It gives longer continuous runs, less down time, and can cut scrap losses as much as 90%. The Kone Pak is mounted on a disposable wooden pallet, and can be packed in streamlined cardboard container if desired.

SHEFFIELD ARMCO® WIRE PRODUCTS

Coiled Wire

Annealed—#20 (.035" ga.) through 1"

Galvanized—#20 (.035" ga.) through #4 (.225" ga.)

Bright—#20 (.035" ga.) through 1"

Straightened and Cut Wire

Annealed—#20 (.035" ga.) through ¾"

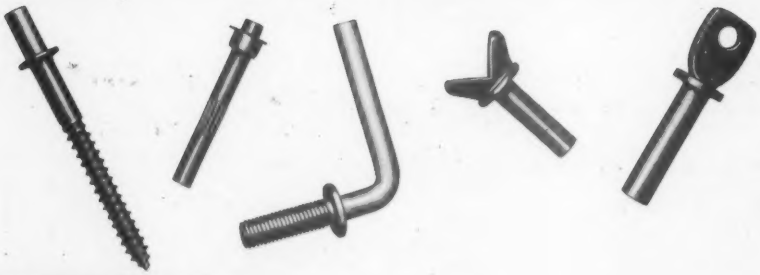
Galvanized—#20 (.035" ga.) through #4 (.225" ga.)

Bright—#16 (.0625" ga.) through ¾"

* Patent Pending

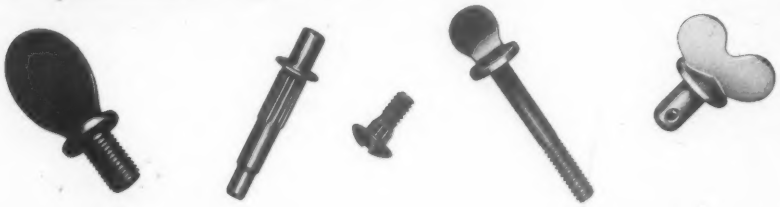
New ALUMINIZED WIRE
16 ga. (.0625") through 6 ga. (.192")
WRITE FOR FREE SAMPLE

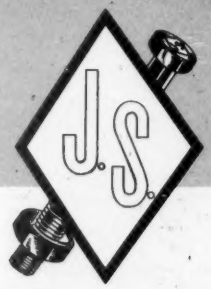
SHEFFIELD DIVISION
ARMCO STEEL CORPORATION
SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA



Consistent Quality Reduces Costs...

KEYSTONE XL WIRE STUDY





J. Schwartzman Mfg. & Supply Co. achieves savings 5 ways with KEYSTONE XL WIRE

J. Schwartzman, who heads the manufacturing company bearing his name, is a strong booster of Keystone "XL" Wire. His plant at North Hollywood, Calif., manufactures millions of fasteners of every shape and description. He points out that Keystone "XL" Wire helps cut costs and improves quality in these five ways:

- Increased die life
- Longer production runs
- Fewer rejects
- Better surface for plating
- Excellent heat treating qualities because of consistent chemical analysis

Here's an example of how Keystone "XL" Wire's *flowability* and consistent quality have reduced costs at Schwartzman Mfg. & Supply Co.: a particular square head set screw formerly cost $9.00 per 1000 to produce . . . now with Keystone "XL" Wire the cost is reduced to $3.50 per 1000 . . . a savings that Schwartzman passes on to the customer. *Flowability* is the secret.

Increased savings and quality like this may be possible on the fasteners or parts that you manufacture, too. It's easy to find out . . . just call your Keystone Representative for the complete story. He will help you investigate the many money-saving applications of Keystone "XL" Wire.

Keystone Steel & Wire Company, Peoria, Illinois

KEYSTONE
WIRE FOR INDUSTRY

Keystone Steel & Wire Company
Peoria 7, Illinois

COLD HEADING FACTS FOLDER . . . send coupon today! New folder discusses uses, applications, methods, technical facts, wire requirements.

Name_____ Title_____

Company_____

Street_____

City_____ State_____

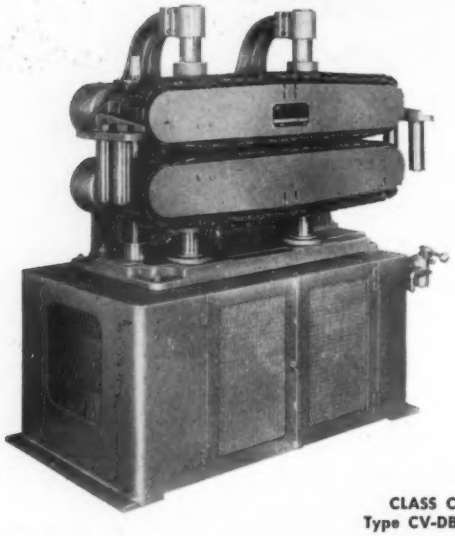
*High-Efficiency** CATERPULLERS

With a complete range of speeds, pulls and capacities.
Choice of horizontal and vertical types.

NEW EFFICIENCIES
Improved drive • Air-Loaded Heads
Non-destructive, controlled gripping
Anti-friction tracks
Greater pulls at lower H.P. input

CLASS D
Type D-VA-72

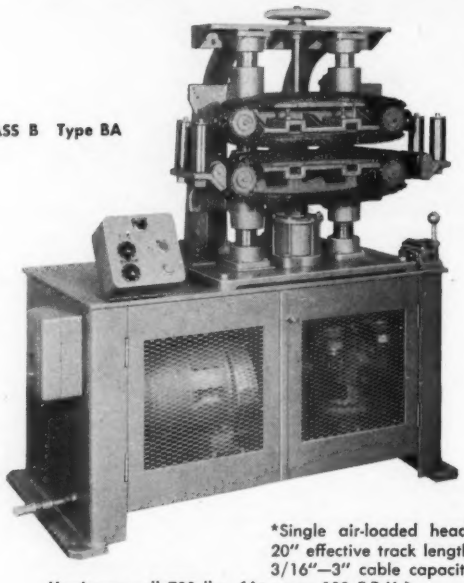
*Multiple air loading
*All right angle drives eliminated
45" effective track length • 3/16"—6" cable capacity
Maximum pull 4000 lbs. (At up to 90 F.P.M.)
650 F.P.M. maximum recommended operating speed
Floating track design • For inputs up to 15 H.P. maximum



CLASS C
Type CV-DB-40

*Double air-loaded heads
30" effective track length • 3/16"—6" cable capacity
Maximum pull 6000 lbs. (At up to 65 F.P.M.)
500 F.P.M. maximum recommended operating speed
For inputs up to 20 H.P. maximum

CLASS B Type BA



*Single air-loaded heads
20" effective track length
3/16"—3" cable capacity
Maximum pull 700 lbs. (At up to 100 F.P.M.)
500 F.P.M. maximum recommended operating speed
For inputs up to 3 H.P. maximum

CLASS C Type CHA

*Single air-loaded head
Horizontal tread arrangement
30" effective track length • 3/16"—6" cable capacity
Maximum pull 6000 lbs. (At up to 60 F.P.M.)
For inputs up to 15 H.P. maximum

GENERAL INFORMATION

All units are available with readily interchangeable treads with a choice of durometers. Treads can be contoured to match cable diameter to minimize unit pressure. Units are available with or without drives.

ENTWISTLE
Manufacturing Corporation

1475 ELMWOOD AVE., PROVIDENCE 7, RHODE ISLAND

FORMVAR... the name everybody depends on!

For more than 15 years wire enamels based on Formvar have been the industry standard. These enamels have proved they possess the necessary balance of properties and they have established an unequalled record of dependability.

That's why more than 70% of all magnet wire is coated with an enamel based on Formvar. These enamels are outstanding in:

Coating uniformity and smoothness
Abrasion resistance
Heat shock resistance
Dielectric resistance, dry and wet
Resistance to thermoplastic flow
Resistance to solvents
Flexibility
Adherence

For wire insulations which permit trouble-free service, lower maintenance and production costs, and greater efficiency, look to enamels based on Formvar. Shawinigan's exacting production controls and active applications research keep Formvar a uniform and dependable ingredient for magnet wire enamels. Shawinigan Resins Corporation, Springfield 1, Mass.

SALES OFFICES: ATLANTA CHICAGO LOS ANGELES NEW YORK SAN FRANCISCO

FORMVAR®
polyvinyl formal by

SHAWINIGAN RESINS

ELECTRIC WIRE & CABLE SECTION NEWS

At a meeting of the Committee on March 25, 1958, in New York City, several important decisions were arrived at, bearing upon future Association policies with respect to this Section. These were:

- The Committee will be responsible, in association with meeting program committees, for securing papers relating to electric wire and cable for the programs of the annual convention and the regional meetings.

- The Committee will organize a Papers Reviewing Committee whose job it will be to upgrade the quality of the papers and check the authority of technical information.

- The Committee is to plan subjects treated so that papers, at least in any one technical session, bear a relation, one to another.

The decisions of the Committee are to be submitted to the Association's Board of Directors for approval at the annual Spring meeting.

The Committee

Since publication of the committee membership in March, new members have been added. The complete list presently is as follows:

Hugo W. Biskeborn, Dir. of Mfg. (Chairman)
Ansonia Wire & Cable Co.
111 Martin St., Ashton, R. I.

Harold W. Adams, Prod. Supvr.
Cable Div. Reynolds Metals Co.
2500 So. 3rd St.
Louisville 1, Ky.

David Barr, Plant Eng.
National Electric Products Corp.
338 14th Street
Ambridge, Pa.

Grover W. Brown, Mgr., Machinery Development
The Okonite Co.
Passaic, N. J.

G. E. Forsberg, Vice-President
Surprenant Manufacturing Co.
172 Sterling St.
Clinton, Mass.

Charles M. Fredrickson
Southern Electrical Corp.
P. O. Box 989, Chattanooga, Tenn.

James S. Higgins, Plant Eng.
Walker Brothers,
Conshohocken, Pa.

R. W. Higginbottom, Chief Cable Eng.
Triangle Conduit & Cable Co.
P. O. Box 711
New Brunswick, N. J.

Alexander A. Kerr, Supt.—Prodn.
Electrical Wire Div.
John A. Roebling's Sons Corp.
Trenton 2, N. J.

Clement C. Lawson, Plant Facilities Engineer
Bell Telephone Laboratories, Inc.
Murray Hill, N. J.

Alfred H. MacGillivray, Supt.
Collyer Insulated Wire Co.
249 Roosevelt Ave.
Pawtucket, R. I.

Urbain J. H. Malo, Technical Dir.
The Crescent Co., Inc.
Front & Central Ave.
Pawtucket, R. I.

W. R. Moyers, Chief Eng.
Wire Engineering Dept.
Western Electric Co.
P. O. Station B
Buffalo 7, N. Y.

J. C. Murray, Jr., Vice-President
Crescent Insulated Wire & Cable Co.
319 N. Olden Ave.
Trenton 5, N. J.

D. M. Schmid, President
Techalloy Co., Inc.
Rahns, Pa.

Philip H. Snyder, Plant Mgr.
Wire and Cable Div.
The Electric Auto-Lite Co.
601 Poplar St.
Hazleton, Pa.

H. S. Spaulding, Tech. Supt.
Kaiser Aluminum & Chemical Corp.
P. O. Box 671, Newark, Ohio.

Roger T. Stafford, Project Engineer
Kennecott Wire & Cable Co.
Phillipsdale (Rumford 16), R. I.

Marshall V. Yokelson, Res. Met.
General Cable Corp.
Bayonne, N. J.

Further details will be reported as they develop.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

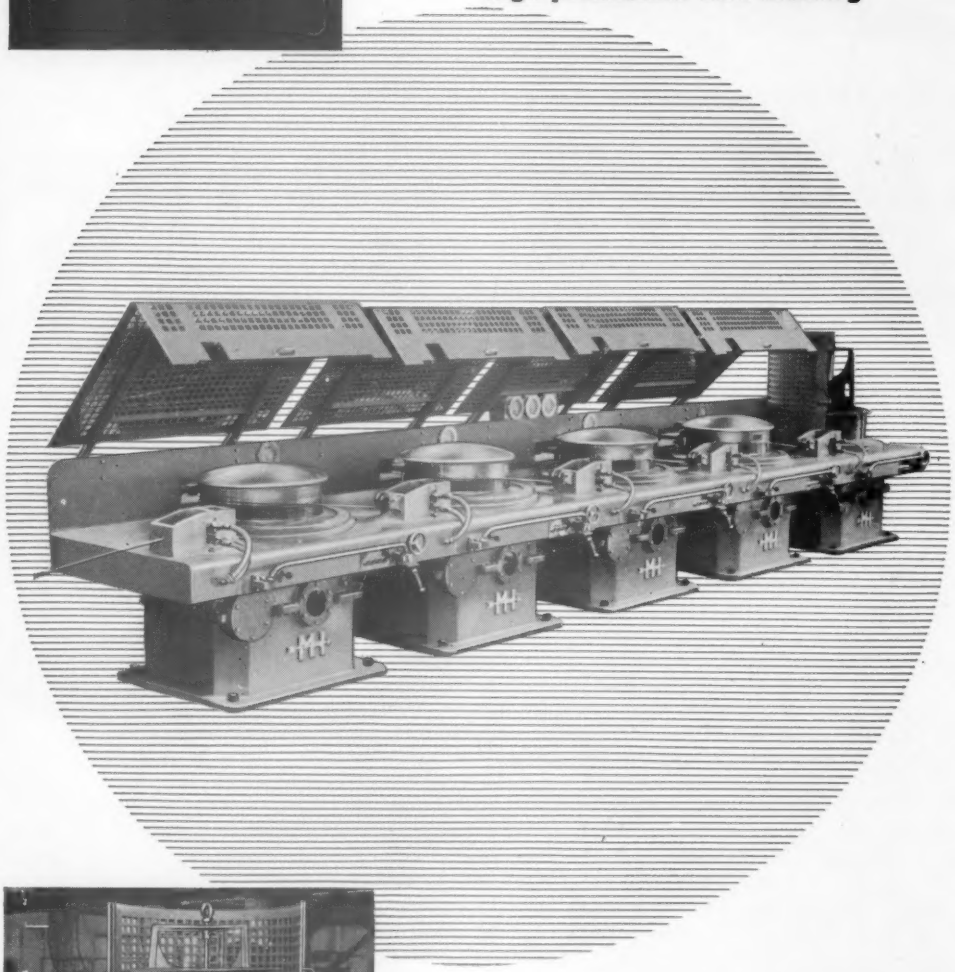
453 MAIN STREET • **STAMFORD, CONN.**

Three sizes for all types of material
Optional number of blocks

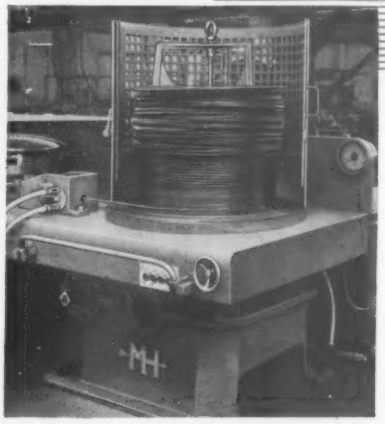
Our experience in building wire drawing equipments during 60 years is your guarantee

THE BEELINE

Designed and built to meet today's requirements for trouble-free high production wire drawing



The heavy size: BEELINE DG 5 with five 28" blocks



Easy "casting" control

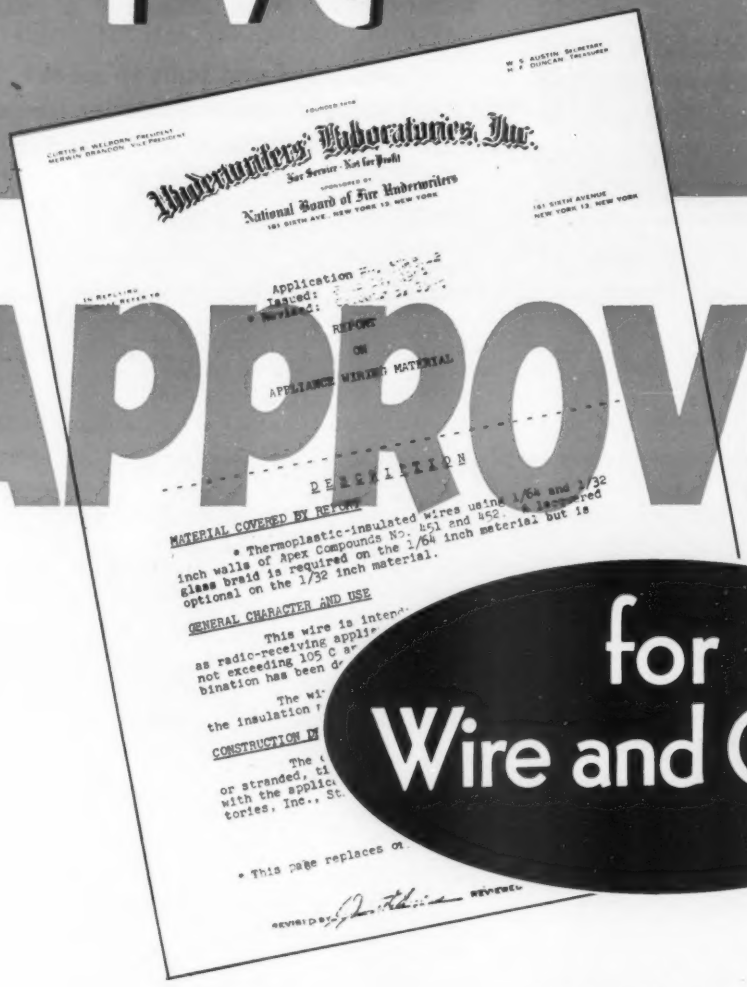
In order to better serve our customers on the American continent we are opening an office in the States in July
Please contact us at:
19002 Lomond Boulevard
Cleveland 22, Ohio

MORGÅRDSHAMMAR

MORGÅRDSHAMMARS MEK VERKSTADS AB • MORGÅRDSHAMMAR • SWEDEN

Cable: Morgårdshammar, Ludvika. Telephone 0240–71100.

APEX PVC COMPOUNDS


Underwriters' Laboratories, Inc.
Not for Profit
Sponsored by
National Board of Fire Underwriters
REPORT
ON
APPLIANCE WIRING MATERIAL
DESCRIPTION
MATERIAL COVERED BY REPORT
• Thermoplastic-insulated wires using
GENERAL CHARACTER AND USE
CONSTRUCTION
• This page replaces

APPROVED

for Wire and Cable

We produce the PVC compound for your requirements . . . or we will develop a compound especially for you!

Apex Tire & Rubber Company entered the field of PVC compounding for the wire industry in 1945. Apex has become one of the leading producers of vinyl materials. Alert research, quality control, and technical service departments are at your service. Compounds are developed in a modern, well-equipped laboratory to meet different specifications required by Underwriters' Laboratories and industry needs.

Technical data supplied on request.

APEX TIRE & RUBBER CO. Plastics Division **Pawtucket, R. I., U. S. A.**

MICROMETER PRECISION – MICRO-WELD ®

MICRO-WELD BUTT WELDERS . . .

the Machine That Made Possible The Continuous Drawing of FERROUS and NON-FERROUS Wire and Rod!

Over a quarter of a century of experience in this highly specialized field has made MICRO-WELD Butt Welders Standard equipment of the American and Canadian wire industry.

MODEL E-1-C
MICRO-WELD BUTT WELDER
Suitable For
Bench Mounting

SPECIFICATIONS

MODEL E-1-C MICRO-WELD BUTT WELDER MOUNTED ON 4-WHEEL TRUCK

Capacity .015" to .050" Diameter Copper—Copper Alloy and E.C. Aluminum.

MICROMETER PRECISION – MICRO-WELD ®

For further information – write or call

MICRO PRODUCTS COMPANY

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HUBBARD HAS IT

If it's a spool or reel, HUBBARD makes it.

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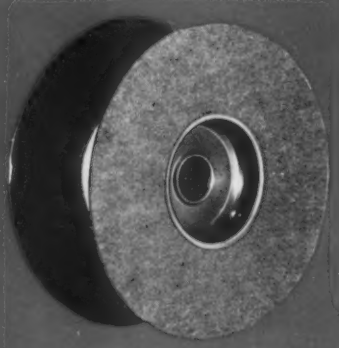

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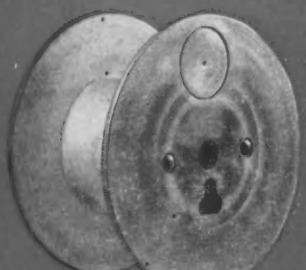

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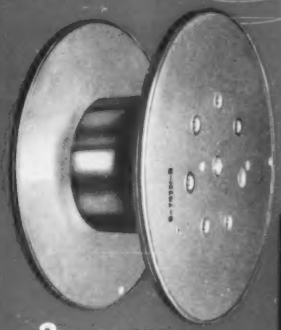

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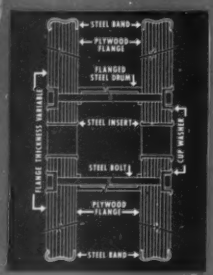

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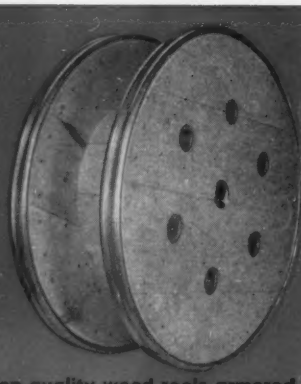

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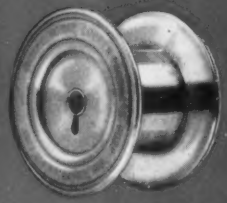

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The Wire Outlook

The conviction is growing that the recession's days are almost numbered and after a level period through the summer, a slow but steady improvement will set in.

This is borne out by the steadiness of personal incomes, the rise in steel output, the increase in machinery and equipment orders, the betterment in mill orders, and the decreases in unemployment. The increases noted are small and below normal levels, but may be interpreted as favorable straws in the business wind.

Excess productive capacity still plagues industry and it is pointed out that the number of people in the 25 to 45 age group, who are the ones most likely to buy homes, furniture, autos, etc., will be declining until about 1962. Getting back to the days of boom-prosperity therefore is likely to be a slow and gradual process.

Housing starts rose in April to an annual rate of 950,000, after two months of decline. About one million houses are expected to be built this year. Construction, as a whole, may be one of the bright spots of the year due to the heavy volume of public building expenditures. Farm prices and farm income both have risen and while it is said that recessions are bred on the farm, it is certainly not true in this instance, since farm income has been rising since last September.

Over-all personal incomes showed an increase in April for the first time in eight months, the increment amounting to $600 million. Personal expenditures are holding up well, especially for non-durable goods and services. This has been an element of strength all through this period, as it indicates public confidence.

Machine tool orders have gone up for three consecutive months, and while the total is not all that could be desired, the trend is encouraging. The stock market, too, continues to register confidence; whether it is the result of expectation of better profits or just a reflection of inflationary forces is anybody's guess.

Inflation we have and will continue to have as long as labor keeps demanding higher wages. The record of our economy is that wages have risen year after year inexorably. The disturbing thing about inflation is that in the last seven years corporate profits have decreased by $2 billion, while wages have increased by $95 billion, much of which can be attributed to the constant increase in printing press money. No nation that multiplies money faster than the production of real wealth—goods—can escape inflation. In 20 years we have quadrupled our supply of money, its buying power has been cut in half and the population has only increased by one-third.

There has been a pickup in reinforcing mesh and in wire and strand for prestressed concrete, but bookings of orders for manufacturers', heading and spring wire continue to be light and on a hand-to-mouth basis. Much dullness is, of course, due to the small demand from automotive sources. Wire rope orders are very poor. In some few quarters, wire orders have improved, although this is not general.

While plans for government expenditures have been considered to be an important factor in stimulating industrial activity, it seems apparent that the chief impetus to business recovery will come from business itself. The administration has been slow to act due to the conviction that the bottom has been reached. If business and industry do assume leadership in bringing about recovery, it will be healthier for the economy. The tone of strength and the growing optimism being evidenced now are good signs; continued confidence in the future is basic to a materialization of prosperity.

Edmund Duval Sickels
EDITOR

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Application Aspects of Wire Mesh Welding

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This paper was presented by the author at the Buffalo Regional Meeting of The Wire Association on May 1, 1958.

Wire welding, like the automobile, is not new but every year new phases are added and the 1958 model automobile is startlingly different from its 1904 predecessor. Wire welding equipment has not kept pace with the automobile, for example, and represents far less change in design for a similar period. However, the forward look in industry is also affecting the design of wire mesh welders and it is anticipated that many more improvements will be added in the years to come.

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Not only will the machines have a face lifting and considerable revamping, but new alloy steels will be increasingly applied because of their increased strength characteristics. Just like airplane design, we believe more emphasis on weight reduction for a given strength, will also be a factor in wire mesh welding. Not only does it effect a saving of our natural resources but it enables manufacturers more effectively to meet tougher competition.

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The mesh industry must consider the labor cost per unit of finished material. Here again we encounter increased emphasis on labor saving means, both as applied to an automation type device and one that is very flexible, to minimize downtime when changing fabric patterns. Without question, the making of fabric was one of the first industries to be highly automated. For this very reason, improvements of any consequence were slow in being adopted as compared to other industries. The saying that we have done it for years and it works all right somewhat precluded a fresh outlook on potential changes. The fact remains that equipment design became so close to standardized that many producers of wire mesh built their own welding machines patterned after some of the first designs in the industry. If one were to visit a number of mills that have been making mesh for years, this would be quite self-evident. No doubt each manufacturer believes that his model is a little superior to his neighbor's, but the family resemblance is quite startling.

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The purpose of this discussion is to bring to the forefront the various facets of application that must be considered when approaching the new look in wire mesh welding. Basic factors such as material weldability, weld strength, machine electrical characteristics, general machine characteristics and wire handling, as related to a fully automated line, are to be covered the better to enable process engineers and management to procure equipment most suited to particular requirements.

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The first question is that of weldability. The rapidly changing demands of industry promote new materials which may be used to match varying requirements. A list of the common materials on which information is ordinarily requested is listed as follows:

Mild Steel

Clean, low carbon steel wire has been the mainstay of the industry since its inception and is still without question the most easily welded.

High Carbon Steel

The welding of carbon steels up

to 1030 does not present any particular difficulty. Steels with more carbon represent a problem because of the resultant embrittlement. Carbon steel may be resistance welded, but usually this is done with some type of post heating cycle to normalize the welds and keep them ductile. Doing this on conventional mesh welding equipment ordinarily requires slowing the machine to give adequate time at lower heat values to obtain an anneal cycle and the required ductility.

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This represents a very decided compromise with high production and would, in effect, materially increase the labor cost per unit of mesh and reduce the productive capacity of a given machine. For these reasons, high carbon steel is ordinarily not considered except in special cases that will justify reduced production and increased cost.

Stainless Steel

This is one of the high strength alloys that is very easily welded. The higher electrical resistance of stainless steels permits lower values of welding current. However, due to its higher heat hardness, welding pressures must be increased to obtain high quality welds. Therefore, the increase in weld pressure, even though the weld current may be decreased, presents a limiting factor for its use on a given machine unless the equipment was designed for adequate high pressures.

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An alternate method of obtaining increased pressure for each weld is to change the pattern to reduce the number of weld joints or to decrease the size of the wire.

Low Alloy Steels

In general, these can be welded without too much difficulty, except that weld pressures are ordinarily increased as compared to low carbon steels. The exceptions to straight forward welding are those steels that have air hardening characteristics. Longer welding time can sometimes be applied to such materials and a satisfactory joint be obtained.

Aluminum

Aluminum can and is being welded daily in the fabrication of numerous items, but it is used more particularly in the aircraft industry. Therefore, when we advise that aluminum on conventional mesh resistance welders is not practical, the reasons must be explained.

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The material is very soft as compared to steel and for that reason a so-called cross wire weld is very difficult to make except under near laboratory conditions. Such welding, therefore, requires an individual adjustment of closely controlled pressure, weld current, and weld time for each single cross wire weld junction. It is not difficult to imagine the gargantuan proportions of such a machine with a separate sensitive pressure regulating device, separate weld transformer, and separate precision weld timer, perhaps with individual voltage regulation, heat control, etc., for each weld.

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To put it another way, such a machine could be built but only at unusually high cost and relatively low production. The electrodes on aluminum welders must be cleaned of the aluminum oxide built up after 150 to 200 welds. Just imagine stopping a mesh welder after this many welds and polishing both top and bottom electrodes before proceeding with production.

Non-Ferrous Alloys

Aluminum was treated separately because of the emphasis that has been put on this material in the last few years. However, there are certain non-ferrous alloys of bronze and brass particularly that make very good welding applications. In general, those alloys with lower conductivity make the most weldable combinations.

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Practically any of the non-ferrous materials require higher weld current values due to their low electrical resistance. Along with the higher heat values, lower welding pressures are used.

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When discussing weldability it would be most remiss not to cover factors other than strictly machine settings that control quality of welding. The Nemesis of most producers is rust. Some slight film of rust may be tolerated, but heavy rust is an insulator and as such, will cause irregular welding, arcing, and burning.

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Another bugaboo, sometimes overlooked, is drawing compound or oil. A light film of oil ordinarily does not noticeably affect resistance weld quality. Heavy coatings of oil or drawing compound have the same insulating effect as rust with the same, sometimes spectacular, unsatisfactory results.

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Many of the producers of wire mesh are also steel makers with their own wire mill equipment. For this reason it may be somewhat derogatory to even mention laminated material. In some instances considerable difficulty has been experienced with laminated stock, again with quite fiery results and no welds.

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Wire protective coatings such as galvanizing have been used for years. No doubt as the demands and uses of wire mesh products increase, other coatings will be used. It is generally necessary to penetrate the coating before a proper weld can be obtained. Many of the metallic coatings used are fair electrical conductors and do not present a difficult problem. Frequently there is a pick up of the coating on the weld dies. If the coating material is lower in conductivity than the wire being welded, erratic welding may result.

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The higher conductivity of the coating, the better the welding will be and conversely the higher the resistance of the coating, the

more difficult it is to make uniform welds. The extreme case is an out and out insulator which precludes resistance welding.

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The second point of significance is that of weld strength.

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The tables shown in Figure 1 are taken from the RWMA Resistance Welding Manual, 3rd edition, Volume #7, page #88. As will be noted in the tables, welding times up to sixty cycles have been used in the making of one half inch diameter cross wire welds. Understandably this would not be suitable to mesh welding because of limiting the speed of the welding machine.

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It must be understood that the approximate welding requirements of the lightest wire in a cross wire weld are used. Therefore, if #0 wire is being welded to #0000 wire, the welding conditions would be set up approximately on the basis of welding the #0 wire. This is not absolutely true, but is close enough for an estimate in calculating machine requirements and setting up for various mesh patterns and gauges. The basic conception that I^2R times a constant denotes the heat in a weld is helpful in analyzing the weld requirements for various percentages of set down and weld strength.

WELDING DATA CHART

CROSSED WIRE WELDING OF LOW CARBON STEEL WIRE

WIRE DIA. IN.	COLD DRAWN WIRE				HOT DRAWN WIRE			
	WELD TIME CYCLES	WELD FORCE LBS.	WELD CURRENT AMPS.	WELD STRENGTH LBS.	WELD TIME CYCLES	WELD FORCE LBS.	WELD CURRENT AMPS.	WELD STRENGTH LBS.
	15% SET-DOWN				15% SET-DOWN			
1/16	5	100	600	450	5	100	600	350
1/8	10	125	1,800	975	10	125	1,850	750
3/16	17	360	3,300	2,000	17	360	3,500	1,500
1/4	23	580	4,500	3,700	23	580	4,900	2,800
5/16	30	825	6,200	5,100	30	825	6,600	4,600
3/8	40	1100	7,400	6,700	40	1,100	7,700	6,200
7/16	50	1,400	9,300	9,600	50	1,400	10,000	8,800
1/2	60	1,700	10,300	12,200	60	1,700	11,000	11,500
	30% SET-DOWN				30% SET-DOWN			
1/16	5	150	800	500	5	150	800	400
1/8	10	260	2,650	1,125	10	260	2,770	850
3/16	17	600	5,000	2,400	17	600	5,100	1,700
1/4	23	850	6,700	4,200	23	850	7,100	3,000
5/16	30	1,450	9,300	6,100	30	1,450	9,600	5,000
3/8	40	2,060	11,300	8,350	40	2,060	11,800	6,800
7/16	50	2,900	13,800	11,300	50	2,900	14,000	9,600
1/2	60	3,400	15,800	13,600	60	3,400	16,500	12,400
	50% SET-DOWN				50% SET-DOWN			
1/16	5	200	1,000	550	5	200	1,000	450
1/8	10	350	3,400	1,250	10	350	3,500	900
3/16	17	750	6,000	2,500	17	750	6,300	1,800
1/4	23	1,240	8,600	4,400	23	1,240	9,000	3,100
5/16	30	2,000	11,400	6,500	30	2,000	12,000	5,300
3/8	40	3,000	14,400	8,800	40	3,000	14,900	7,200
7/16	50	4,450	17,400	11,900	50	4,450	18,000	10,200
1/2	60	5,300	21,000	14,600	60	5,300	22,000	13,000

TABULATED STRENGTHS OF CROSSED-WIRE WELDS FOR SPECIFIED PERCENTAGES OF SET-DOWN

Figure 1—Cross wire welding statistics.

It is quite interesting to note that the increase from 15% to 30% set down increased the joint strength by from 11 to 16% approximately. The same approximate difference is noted between 30% and 50% set down. Also, the current squared is proportional to amount of set down.

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The data as shown is most useful in determining KVA requirements in machine design. It also permits calculating the approximate requirements for varying gauges of material and % set down.

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The third point of great interest when applying mesh welding equipment is the electrical character of the circuitry and power installation required. The final total K.V.A. requirements for any given machine are dependent upon the efficiency of the secondary circuit and the size of work being welded. Each manufacturer's equipment will vary in this respect and information for exact figures are, therefore, obtainable only from the machine manufacturer.

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The types of secondary electrical circuits break down into three general classes, namely; Direct Welds, Series Welds and Indirect Welds. (See figure #2). For years

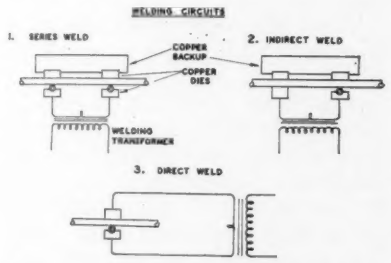

Figure 2—Welding circuits.

series welding was in ill repute, primarily, it is believed, because of the misapplication in electrode position relative to the joints. When making series welds on cross wire welding, it is imperative to apply the two electrodes to the longitudinal wires and not to the cross wire. (See sketch figure #3 showing right and wrong method). By the correct method all of the current, both that carried through

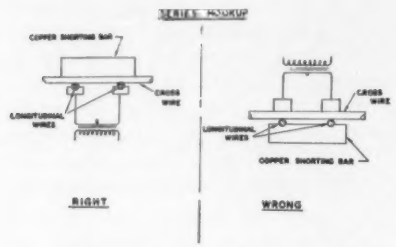

Figure 3—Sketch—correct and incorrect application of series welds.

the cross wire and the current carried through the shorting die that backs up the cross wire, is pushed through the weld joint. If the wrong method is used, the shunting current across the cross wire does not go through the weld joint and in close spacing makes a very inefficient weld condition due to surface heating but not heating at the weld joint.

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The use of series welding was further criticized because the same current must go equally through two weld joints. Therefore, if either joint is of poor quality due to rust, dirt, or other poor welding condition, both welds may suffer in quality. Also, the adjustment of heat can be made by the two joints only and not for each individual weld. Both of these criticisms are true but in actual practice, it has not proven a handicap.

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Using clean wire as obtained from most mills, there is very little difficulty in obtaining equal or nearly equal electrical resistance through both weld joints in series. Furthermore, the individual adjustment of weld heat for each weld joint may be accomplished as easily with individual weld pressure adjustment as it is with heat or current adjustment. The proof of the method is borne out by the great number of machines that are successfully using series welding on production.

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The great advantage of series welding is the simplification of the weld circuit and the fact that two welds may be made with practically the same power input as it would take to make one weld by direct welding. It is generally true that a direct welding circuit due to clearance problems is less efficient than that generally obtained by the series method on mesh welders.

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Indirect welding is in effect a variation of series welding and is used primarily to simplify the moving of guns or obtaining differing spacings without the removal of guns, the shifting of transformers, or the drastic changing of the secondary electrical circuit.

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Figure 4 is a diagramatic sketch of a complete electrical hookup for a mesh welder with the welding transformers shown on one phase only. The other two phases would be hooked up similarly. By this method, it is possible to balance a three phase power system by means of individual heat control on each phase through a tube contactor and phase shift heat control. For wide variations of weld current requirements, auto transformers are used in each phase to give very coarse adjustments.

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It is most desirable when using phase shift heat regulation with Ignitron Contactors to keep the heat adjustment at a relatively high value. This is true because of the higher power factor obtained on higher heat settings. Therefore, the auto-transformer would be adjusted to throw the phase shift heat setting in the 80% to 100% range giving close to the maximum power factor obtainable on any given machine.

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Each welding transformer has a high and low heat adjustment so that in a given welding setup it is possible to regulate the weld current between transformers that are making two welds in a series circuit and a transformer that is making only one weld by the indirect method. Such a system is easily and quickly adjusted for any given pattern and weld requirement.

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The power may be distributed on a three phase system and each phase equally loaded. This makes the power companies very happy, but it does not eliminate the high instantaneous loads common to resistance welding techniques which makes the power companies unhappy. The most objectionable feature from the power company's standpoint is the flicker caused by the intermittent load on the power lines. This frequently brings numerous complaints from householders and customers of the gin mills watching colored TV. It also may cause an objectionable light flicker problem. Fortunately, this particular phase of resistance welding

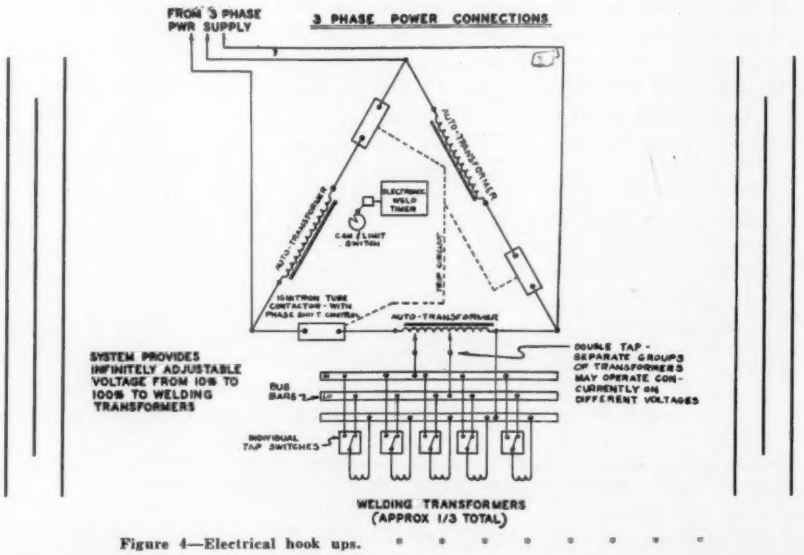
FROM 3 PHASE PWR SUPPLY
3 PHASE POWER CONNECTIONS
AUTO-TRANSFORMER
ELECTRONIC WELD TIMER
CAM LIMIT SWITCH
AUTO-TRANSFORMER
SYSTEM PROVIDES INFINITELY ADJUSTABLE VOLTAGE FROM 10% TO 100% TO WELDING TRANSFORMERS
BUS BARS
DOUBLE TAP - SEPARATE GROUPS OF TRANSFORMERS MAY OPERATE CONCURRENTLY ON DIFFERENT VOLTAGES
INDIVIDUAL TAP SWITCHES
WELDING TRANSFORMERS (APPROX 1/3 TOTAL)

Figure 4—Electrical hook ups.

stays out of the worst flicker range which is the most noticeable at ten cycles per second. A fast welder running at sixty strokes a minute would have a frequency of only one cycle per second.

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When installing welding equipment, it is to the manufacturer's and user's interest to promote the best plan possible for power application. Therefore, the use of series welds, a balanced three phase system and staying out of the flicker range represent very concrete favorable factors for power installations.

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A fourth basic design element that affects the design of the welding equipment is the method of applying weld pressure to the weld joints. (See figure #5). The most

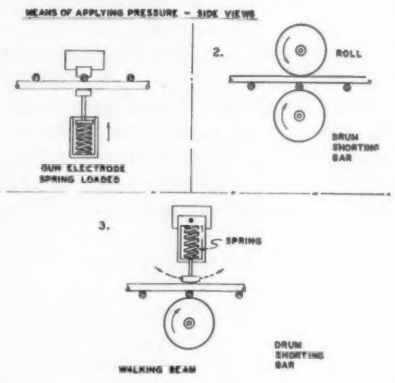

Figure 5—Pressure application.

common is by the use of spring-loaded welding guns which are mounted on a common ram with a reciprocating motion. This requires an intermittent drive for pulling out the line wires and the welded fabric. A great number of methods are used by different manufacturers such as revolving drum, pulling table, or chain puller. Each method has its advantages and disadvantages and the reasons for such are somewhat influenced by the selling "pitch" of each manufacturer.

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Another method of applying weld pressure is by the so-called walking beam method which means that the welded mesh may be moved continuously with a reciprocating, spring-loaded electrode furnishing intermittent pressure against a revolving conductor drum. In this design, the reciprocating motion is combined in the welding gun assemblies instead of the mesh puller drive.

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Still another method is by means of two welding rolls that are operated continuously similarly to most resistance seam welders. This presumably could represent one of the highest productive capacities of any method used, but it has a number of attendant difficulties that are not easily solved. The drum shorting bar as shown in the sketch is easily applied but the individual electrical circuits for each longitudinal wire presents a very major problem. The difficulty is to attach the secondaries of the weld transformers to the welding rolls. Each roll normally would have a seam welding bearing of sufficient size to carry the necessary current. Such bearings are frequently three or four times the width of the roll and it becomes a very difficult space problem.

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Such machines have been built but are primarily used as single purpose equipments with relatively wide spacing between longitudinal wires. The problems of changeover to different weld patterns make this type primarily single purpose. Unfortunately, there seems to be little demand for single purpose machines in the mesh industry. Usually the request made to a welding machine manufacturer is an increase of range and adjustment rather than a narrowing of the specifications.

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It is not the intent of this discussion to recommend various designs or a particular machine of a certain proprietary nature. Rather, it is desired to point out the various methods of achieving wire mesh welding with some of the advantages and disadvantages indicated in considering various designs.

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The steel mills and wire mesh fabricators usually furnish their own particular wire pay off reels for use with this equipment. However, there are some important points that should be noted. The first and most common is the so-called live reel that rotates and unwinds the wire coil as it is being pulled or fed through the welding machine.

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An excellent development along this line is the process of winding the wire directly on the reels from the drawing station and thereby eliminating a second handling. A further trend is the increase of weight of coils up to 3000 pounds and even higher, if desired.

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The requirement for handling such large coils of wire is twofold excluding the mechanical lifting of this much weight and transporting it to the welder pay off station. The first of these is the proper winding so it will be non-kinking on pay off and permit a continuous operation of the welder. An excellent article on this subject was published in the November, 1957, issue of "Wire and Wire Products" by **E. Jefferson Crum.**

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The second consideration is handling the high inertia coil by the normal pulling devices of various welding units. This was believed so important on a particular high speed machine built by our company that we felt it absolutely necessary to use so-called "dead" reels and let only the wire pay off without rotating the reel. This machine will be covered in principle later in this article to better illustrate the problems that arise when combining tremendous coil weight and high speed operation.

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Wire straighteners and the necessity for straightening has been a point of great differences of opinion by operating men. At the present time in our experience, it seems that the general consensus of opinion would tend to simplify straightening devices to one five roll straightener in one plane only. Heretofore on heavier gauge it was a must to have two five roll straighteners 90° apart for proper

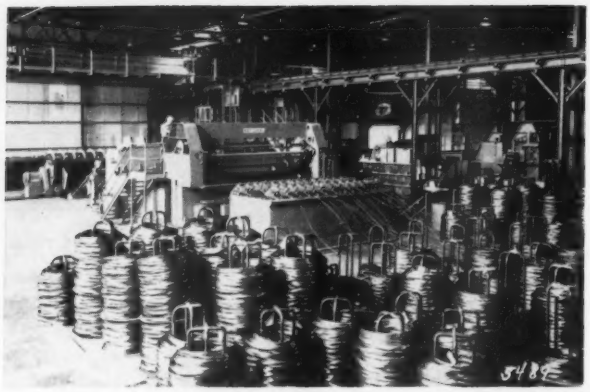

Figure 6—Picture—Single wire machine.

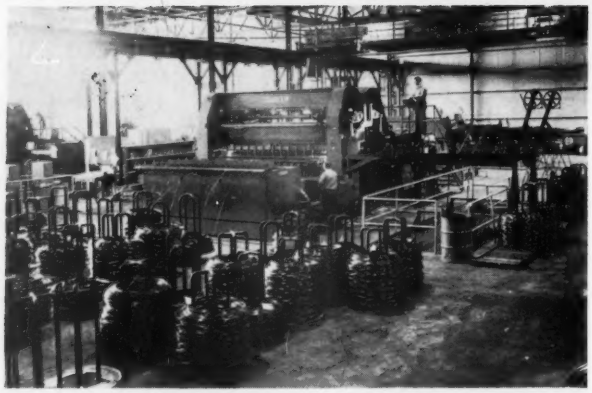

Figure 7—Picture—Two wire machine.

straightening in both directions.

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A gang type straightener is easily built and quickly adjusted when straightening is required in one plane only. Our experience confirms this trend particularly on light wires or wire that is rolled into a coil. The possible exception might be on heavy mats when dead reel pay off is used. This may give a spiral twist unless considerable straightening in two planes is accomplished. A method of eliminating this twist from dead type pay off reels would be to have every other coil unwind in an opposite direction, thereby balancing the spiraling tendency. This sounds easier than its execution if all coils are wound the same, as they usually are.

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Each design has some method of pulling the wire through the welding machine. All of them have their advantages and disadvantages. One of the first methods used was a drum with various projections on the drum to guide the longitudinal wire and also register with a given spacing of cross wire. This permitted relatively easy changeover for varying spacings. However, the disadvantage on most machines of this type is the variation of spacing that results as the wheel wears due to the changing radii resulting.

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Another common method is by means of puller fingers, operating in a horizontal plane. This had quite an advantage in producing a very accurate mesh since the distance of pull can be regulated infinitely. Any odd spacing is easily met on such equipment. Set up time is longer than on the reel machine unless the puller fingers are brought right down to the weld station. If the fingers are installed to operate at the weld station, it means a space problem for clearance on close mesh patterns.

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A method very similar to the puller fingers is the puller chain with lugs on the chain to pull the mesh on a prescribed preset spacing. This gives a flat mesh but the accuracy is only as good as the position of the lugs in reference to the desired spacing. In this respect, it is not too dissimilar from the drum because of the preset positioning which is subject to wear or stretch of the chain.

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Cross wire feeding breaks into two general methods commonly used; namely, hopper feeding of straightened and cut cross wires and feeding from a coil directly into the machine. The hopper feed definitely has an advantage of maximum speed in that the feed time can be less. For example, the distance of feeding the width of the mat versus feeding from the hopper down to the weld station represents a definite time saving. Particularly on heavy gauge wire, a hopper lessens the work of the welding machine and would provide faster operation if wire feeding is the delaying factor. This is not always true because of the longer welding time required for heavy gauges.

The one real disadvantage to hopper feeding is cost. In other words, it is impossible to straighten, cut and deliver these wires to the welding machine for nothing. Because of this, most manufacturers favor the direct feeding of wire into the machine from a coil.

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Feeding from a coil is ordinarily accomplished by power driven pinch type feed rolls with intermittent motion or continuously driven rolls which are lifted from the driven wire in proper sequence to feed the necessary length at the proper machine operating cycle. Regardless of which method is used, this type of cross wire feed permits feeding directly into the machine operation without an extra cost for cut and straightened wires.

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This may be subject to some differences of opinion, but it is believed that the normal method of straightening wire by spinning is not fast enough to keep a high speed machine operating directly from the straighteners. It has also been our experience that cut and straightened wire must be much straighter for hopper feeding than that necessary when feeding from a coil and closely retained during its travel and feeding into the weld station.

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In the final analysis, the choice of methods as outlined above resolves itself into cost and speed of operation.

(*Please turn to page* 804)

Drawing and Insulating Wire in One Tandem Operation

by James F. Stoltz
Chief Engineer, Rod and Wire Mill
Western Electric Company
Chicago, Illinois

Automation, in most cases, is the result of an evolution in manufacturing techniques. The combining of several previously independent processes is part of the evolutionary pattern. This paper was delivered at the Buffalo Regional Meeting of The Wire Association on May 1, 1958, at Buffalo, N. Y.

Engineers at Hawthorne and Montgomery have now developed a new combination of older processes to draw, anneal, and insulate copper wire with plastic in one continuous tandem operation.

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The tandemization of these wire processes reduces the required facilities and floor space as well as the production costs, primarily by the elimination of the transfer of material between the individual processes. Additional by-product advantages are the mechanical superiority resulting from a higher uniformity of wire tension and fewer difficulties with the heavier supply wire, producing a slight increase in output for the insulating line.

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Some of the problems encountered in proving in the system and determining its feasibility were most interesting. For a better understanding of these problems, a brief description of the tandem line is in order.

The Tandem Line

The schematic diagram, located at the bottom of this page, represents the arrangement of the component machines in the line. Fourteen gage hard copper wire is supplied to the line on 1,000-pound spools. This wire enters a wire drawing machine (in a typical case) at a speed of 198 feet per minute and emerges as 24 gage wire at 2,000 feet per minute.

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Being work hardened in the drawing process, it is necessary to anneal the wire "on the fly" so that it will meet the elongation requirements of the finished product. Annealing is accomplished by passing the wire over driven capstans which are electrically connected to pass a current through the wire from one capstan to another. The current is high enough to cause the wire to be annealed by the resistance-heating effect of the current. Inasmuch as copper oxidizes with amazing rapidity when heated to the annealing temperature in the presence of air, the heated span of wire is passed through a tube which is purged with steam. Further, in order to cool the wire to a non-oxidizing temperature before it reaches the air again, the hot wire is passed through a water-filled tube. The wet wire emerging from this cooling tube must be dried, however, and an elevated temperature is almost mandatory to do this effectively. At first drying was done by cooling the wire only partially—to a temperature just low enough to prevent oxidation as well as an undesirable adherence of the plastic insulation to the conductor, which occurs when the wire is too hot. Temperature control by this method was unsatisfactory, however, and a reheating circuit operating on the same principle as the annealing circuit was incorporated in the line. By providing more complete cooling followed by the reheat, adequate temperature control was achieved.

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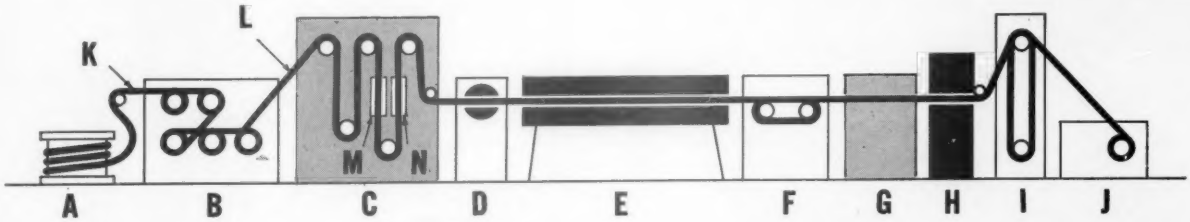
The dry annealed wire is passed through the extruder die which applies a plastic insulation over the copper conductor. The plastic is necessarily hot and soft as it is applied, and so must be cooled be-



SCHEMATIC REPRESENTATION OF A TANDEM LINE

A—1000 pound Supply Spool; B—Wire drawing machine; C—Continuous annealer; D—Plastic Extruder; E—Water cooling trough; F—Non-slip capstan; G—Voltage breakdown tester; H—Photo-electric diameter senser; I—Wire Accumulator; J—Continuous spooler; K—14 ga. wire entering drawing machine; L—24 ga. wire entering annealer; M—Steam tube to be in annealer; and N—Water cooling tube in annealer.

fore the wire makes any further solid contact with sheaves or capstans. For this purpose, the wire travels through a water trough immediately upon leaving the extruder die. The trough is fairly long so that the cooling time is sufficient to permit winding the wire around a double-wheel grooved capstan located at the exit end of the trough. Enough turns are made around this double capstan to assure non-slip operation with normal tension in the wire. Following the capstan, the wire passes through a spark tester to provide continuous testing of the insulation for voltage breakdown, followed by a photo-electric type diameter sensing device, wire accumulator, and finally the continuous spooler. The spooler is a dual unit type with means for on-the-fly transfer of the wire from one spool to the other so that the line can continue to operate while full spools are replaced with empty spools. Rotating speed of the spools is controlled by the wire accumulator to provide automatic control of take-up speed as the diameter of the spool is increased by filling with wire.

Speed Control

The wire drawing machine, annealer, extruder, and capstan units are each driven by a Dynamatic motor-clutch combination to provide variable speed control through variation of the field strength of the magnetic clutch. Field current for each clutch is supplied through an electronic amplifier so that relatively delicate sensing devices may be used to determine speed relationships. The speed of the extruder (rate of plastic extrusion) is determined by a manual setting of a potentiometer. The speed of the wire drawing machine is controlled by the photo-electric diameter sensing device. Thus, outside diameter of the insulation is automatically controlled through regulation of the speed relationship between the extruder and the wire. This effect is achieved indirectly, since the wire speed is actually determined by the speed of the non-slip capstan. This capstan and the annealer are synchronized to follow the speed of the wire drawing machine.

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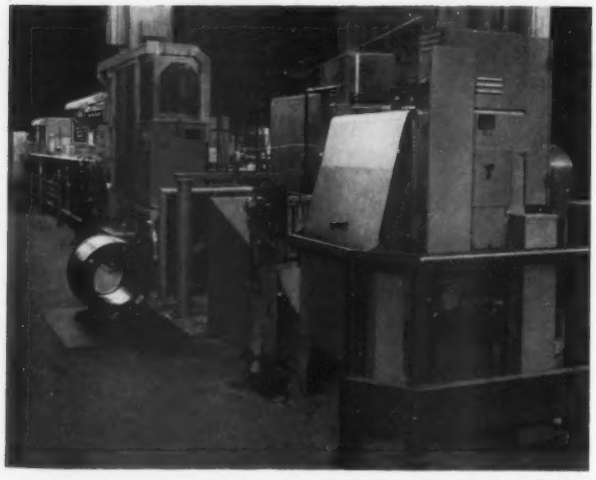
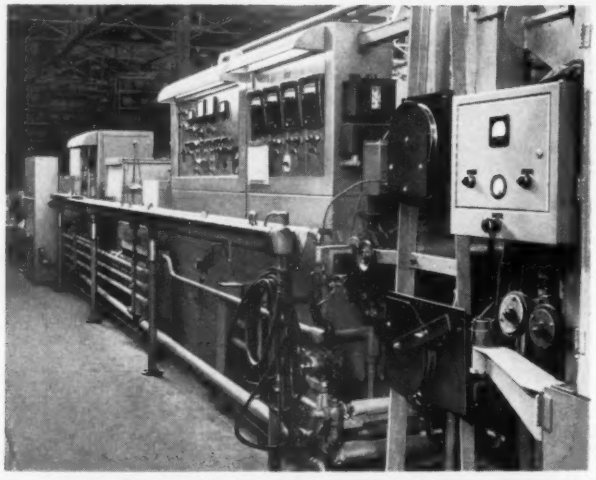
Exact synchronization for continuous wire machinery is particularly critical since any error which is present is accumulative. Also, the remachining of capstans, needed occasionally to overcome the effects of wear, demands an increase in rotational speed to compensate for the diameter reduction. Maintaining exact synchronization during such changes is very difficult. The synchronization problem may be treated in several ways—in this case it was alleviated by providing for a few percent of slip on the capstans of two of the three interconnected units. By causing the slip to occur at the wire drawing and annealing units, another important advantage was gained. It is a well known fact that the tension required to pull wire through a drawing die with a given diameter reduction is independent of speed. In addition, when the wire is passed over a slipping capstan, the familiar formula for slipping belts applies and therefore, a constant ratio is maintained between the tension of the wire approaching the capstan and the tension of the delivered wire. The constant tension provided by the drawing die combined with the constant tension ratio which is an inherent characteristic of the slipping capstan results in a highly constant tension in the delivered wire. This tension is completely independent of speed so long as any amount of slip is maintained. The wire delivered in this fashion by the drawing machine is similarly treated by the annealer so that constant tension is maintained throughout both units, an advantage not realized with conventional operation where the wire paying off a supply spool enters directly into the annealer. However, this high degree of tension control is of utmost importance in the case of aluminum where tension must be very low and highly uniform in the annealer to prevent objectionable stretching.

Methods for Controlling Clutches

In order to evaluate the relative merits of alternative methods for



Wire drawing machine, right, receives wire from pay-off stand behind it, delivering hard drawn wire, shown leaving top of machine, to the continuous annealer located next in line. Cooling trough of plastic extruder is shown beyond the annealer.



The extruder head that applies plastic insulation to the annealed wire is located in front of the entrance to the cooling trough. At the far end of the trough is the non-slip capstan that governs the wire velocity on the line.

controlling the Dynamatic clutches to maintain the desired speed relationships, three separate systems were tried.

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The first made use of the tachometer generators which are an integral part of the Dynamatic units themselves. The tachometer signal voltage of each of the follower (slave) units was compared to that of the master unit. Differences in these voltages were employed to control the clutch field amplifiers. While this method produced satisfactory operation, there was some instability of the electronic circuits and adjustments were difficult because of the complexity of the system.

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The second system employed differential Selsyn units installed at each machine to maintain the necessary synchronization. This method has the advantage of being self compensating with respect to electronic instability as well as any improper adjustments and has proven to be highly satisfactory in regular production service.

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A third method of synchronization is being employed for a newer tandem line which was installed at Western's Montgomery Shops. This method is the power Selsyn system which is frequently used in steel rolling mills. In this line, the master unit (wire drawing machine) has a Dynamatic drive as previously described. A master power Selsyn unit is driven from the same Dynamatic and is positively geared to the wire drawing machine through timing belts. The annealer is mechanically driven from the wire drawing machine and a slave Selsyn unit drives the non-slip capstan. This system requires virtually no adjustment or attention. It is further considered superior to the other two control systems because of its more positive action, quicker response, simplification, and the economic advantages gained by the elimination of many control components.

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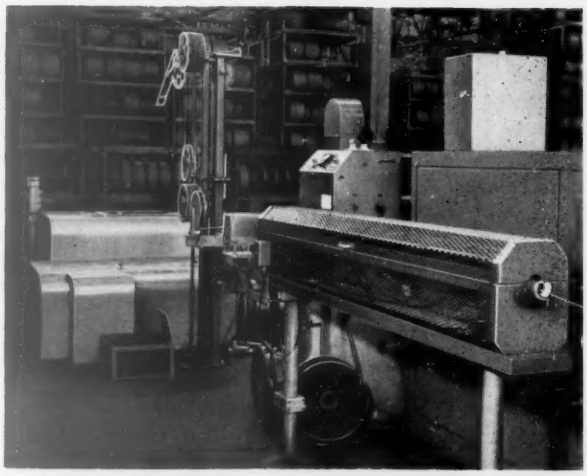
The Montgomery line includes an additional noteworthy feature, an electro-tinning operation between the annealer and the extruder. The tinner is a multipass unit containing four driven electrical contact rolls which pass the wire through a stannous sulphate solution. In this case, a soft-torque non-slip method of synchronization was selected since a slipping contact roll might be deleterious to the quality of the tin coating and because accurate tension control is much less important in the tinner than it is in the annealer where elevated temperatures are employed. Small direct current units drive each roll separately to provide this type of control.



Insulated wire from the non-slip capstan is here shown entering the voltage breakdown insulation test set, at right, whence it goes to a photo-electric diameter senser, a wire accumulator and then to the continuous take-up spooler in the background. * * * * * *

Initial Experiment

The initial experimental work on the Hawthorne tandem line was accomplished by converting a conventional plastic insulating line to tandem operation. For production reasons, the line had to be returned to full three-shift operation on regular product, with or without the tandem operation, within two weeks. The first of three primary objectives of the experiment was to determine the feasibility of tandemization. Secondly, it was important to determine whether tandem operation would, in any way, interfere with a subsequent conversion from copper to aluminum conductors. The third goal was the establishment of operating procedures and preparation for regular shop production on the tandem line by the end of the two-week interval.

After spending the first three days in making final connections, adjustments, and testing of the complex control circuits involved in the line, experimental work was begun. The first objective was achieved without major engineering difficulty. Twenty-two gage copper wire was drawn from fourteen gage supply and delivered continuously to the remaining components of the line under highly uniform tension as predicted. Quality of the finished insulated wire was checked carefully and found to meet all requirements. After producing a sufficient quantity of wire to establish complete assurance of ultimate success for copper wire, this work was temporarily suspended in favor of a pursuit of the more challenging second objective—to achieve successful operation with aluminum wire.

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Because plastic insulated aluminum wire was not in regular production, a number of problems were expected which were not necessarily related to tandemization. It was not the purpose of these experiments to find a solution to all of these problems, but rather to confirm their existence, evaluate the influence which tandemization would have on their solution, and solve any problems arising directly from tandemization.

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One such problem concerned the

very low yield point of aluminum at elevated temperatures and the corresponding low tension which could be allowed in the heated span of the annealer to permit feasibility of such an annealer, so necessary to tandem operation. Any stretch occurring in the wire at this point would reduce its cross sectional area and increase its resistance accordingly. For the initial trials on aluminum, therefore, it was decided that the lowest possible tension would be provided in the heated span of the wire. Fortunately, aluminum does not oxidize a great deal faster at the annealing temperature than it does at room temperature, so that the steam tube could be removed, permitting easy observation and measurement of tensions.

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In a system of slipping capstans such as that used in the annealer, only a few factors have a major influence on the tension ratios. Specifically, these are angular contact between the wire and the capstan, coefficient of friction, and direction of slip. Factors which are normally minor, but which can sometimes become important, are windage, centrifugal force, and the weight of the wire. Except for lubrication, not much can be done about the coefficient of friction and arrangements were made, therefore, to increase angular contact on the capstan preceding the heated span by providing an extra wrap. Anticipating that the tension thus produced would be too low for good electrical contact on the next capstan (at the other end of the heated span), the direction of slip was reversed here by underdriving this capstan to a peripheral speed slightly slower than that of the wire. This change was expected to increase tension in the water cooled span to provide good electrical contact on the aforementioned capstan.

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No attempt was made to apply the plastic insulation during the first runs. Samples of the annealed aluminum wire were carefully checked for diameter, resistance, and elongation. All three of these measurements indicated that the wire was being stretched in the process. Moreover, after running aluminum through the annealer for a short time, a coating of aluminum and aluminum oxide covered the capstan faces and increased the coefficient of friction so that tension in the heated span was reduced even further. Under this condition, the wire became virtually uncontrollable in the annealer. Centrifugal force of the wire on the capstans became a significant factor at the 2,000 feet per minute speed with the result that the heated span was transformed from a straight span of wire to a careening "S" shaped path of wire.

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This condition was corrected by removing the extra wrap of wire from the capstan and it was later concluded that while aluminum does require lower tension in the annealer, this is provided automatically after a short run by the increase in coefficient of friction. Subsequent runs demonstrated that stretch was still occurring and it was found that this same increase in friction caused more tension in the water cooled span than the soft annealed wire could withstand. The under-driven capstan was, therefore, promptly changed to over-drive, contrary to conventional practice. Fortunately, and probably due to the presence of water on this capstan, good electrical contact was maintained even with the lower tensions. After eliminating several minor drag points throughout the system it was finally possible to deliver good quality bare annealed aluminum wire to the extruder die on a reliable basis without significant or even measurable symptoms of stretch.

Measuring Stretch

During the course of these runs, considerable delay was involved in obtaining samples of the annealed wire being delivered to the extruder die. It was known that some stretching occurred at the wire accumulator and spooler units, so that a sample taken from a take-up spool would not be representative of the wire delivered by the annealer. Therefore, it was necessary to obtain samples by cutting the wire at the exit end of the cooling trough while it was running at full speed. With the slipping drive principle employed, this action caused the wire to stop almost instantly, even though the capstans continued to rotate (and slip). This method had the advantage that samples could be taken from various points in the system to help locate the trouble spots, but also meant that the entire line had to be re-strung after each sample was taken.

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To minimize these delays which might have spelled the difference between success and failure within the allotted time available, a method was devised for detecting stretch while the line was in continuous full-speed operation. The method was based on the principle that when stretching occurs in the process, the unstretched wire at the beginning of the system cannot be traveling at the same rate of speed as the elongated wire at the end of the process. In this case, the speed of the wire on the double wheel non-slip capstan is essentially constant and when stretching occurs in the soft wire, the speed of the wire entering the annealer is reduced. If stretch is appreciable, it can be detected easily with an ordinary tachometer type speed indicator. For the detection of smaller amounts of stretch, the stroboscopic tachometer was suitable. While this latter instrument is not completely dependable for absolute speed measurements, it is especially sensitive to relative speed changes. By switching the annealer current on and off with the wire running and while one of the idler sheaves was observed in the light of the stroboscope, minute amounts of stretching in the soft wire could be detected readily.

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In some cases, by observing any time lag between application of the annealing current and an indication of stretch, an approximation can be made of the location of the trouble. For example, if an estimated one-second time lag is observed, it can be assumed that it took that long for the soft wire to

(*Please turn to page* 807)

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Chromates as Applied to Hot Dip Zinc Coated Wire

by M. S. Siddall
Service Manager
Promat Division, Poor & Company
Waukegan, Illinois

A practical paper providing operating information to users of chromates, delivered at the Buffalo Regional Meeting of The Wire Association on May 1, 1958, at Buffalo, N. Y.

Much has been written regarding the use of chromates, or commonly called "conversion coatings." The authors have referred to them primarily as used on acid zinc, cyanide zinc, cadmium and aluminum. Chromates fall primarily into three classes. First, is the iridescent or "yellow chromate"; second, the leached type or "clear chromate"; and third, the commonly known one-dip "bright chromate".

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It might be well to mention a few pertinent facts which characterize each type so that we may better know the feasible application of each. Some may ask, "What is a chromate? . . . a simple chromate is a solution made up of various chromium salts, and in addition may contain inorganic or organic acids and various other chemicals to either act as a buffer or give a chromate the property of imparting a certain characteristic to the film. When zinc or cadmium is immersed in this solution it is attacked by the acid, with an attendant rise in pH at the interface; at a certain critical pH a semi-gelatinous film of tri and hex-chrome of various complexes are laid down on the surface. The ratio of tri to hex is an important factor in determining its protective quality. This factor is controlled to a large extent by the makeup of the chromate, its operating pH, and length of transfer time. The yellow chromate film contains a large percent of hex-chrome whereas the clear chromate is made up largely of tri-complexes. The hex-chrome is referred to as the soluble chrome and the tri- as the fixed chrome.

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The iridescent type gives the best protection, as it is capable of laying down the greater amount of total chrome. It is quite possible to lay down in excess of 45 mg/ft². Even though approximately 40% of this is hex, it is not uncommon for it to be subjected to salt spray for as much as several hundred hours before going to white corrosion.

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The leached type is used where the best possible protection in a bright finish is required on zinc or cadmium. This type is used extensively on refrigerator shelves and deep freeze baskets. There is a considerable amount of hex-chrome laid down with this film also, but after it is passed through the leach tank the resultant film is approximately 85% tri, or insoluble chrome. This type of chromate operates at a very low pH; therefore it has an excellent chemical polishing action. It goes without saying that when using this type of chromate the zinc coating that it is being applied to must be absolutely pure. If the coating contains the slightest trace of copper or lead, the action of the chromate treatment will turn the finish dark.

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The third type, or commonly called one-dip chromate is used most extensively throughout the industry. The film laid down by this type is largely that of tri-chrome complexes and therefore it requires no leaching. When applied to a pure zinc coating it is possible to operate it at quite a low pH thereby getting very good chemical polishing action together with moderate protection. It has not been used very extensively, until the last few years, on hot dip zinc because of the impurities such as lead and aluminum present in the coating. The problem involved in its application has in the past been to lay down sufficient fixed chrome without destroying the brightness of the zinc coating during the processing cycle.

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This paper will deal primarily with the one-dip chromate as applied to hot-dip zinc coated wire, processed on continuous wire galvanizing frames. I might mention here that this process is also in use on continuous sheet galvanizing set-ups.

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In referring to one of the chromates in use today; there are a number of factors involved in accomplishing the desired results. These factors are as follows: amount of aluminum used as a brightening agent in a zinc pot; type of wipes and lubricant used on them, and temperature at which the wire enters the chromate. Factors that influence the function of the chromate are: travel speed of wire, immersion time, chromate temperature, concentration, pH, and tri-hex ratio. I will deal with each of these factors in their respective order, and the effect of each.

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Aluminum is used extensively as a brightening agent for hot-dip zinc. It is generally added in the form of pigs at the end of the pot next to the wipes. Even though

its melting point is several hundred degrees above that of zinc, it alloys with the zinc and can be found in various concentrations throughout the entire mass. Some resort to the use of dams in an effort to keep it at one end, but this method has proven to be not too effective. On one occasion there was considerable discussion in this respect, in which case I spent several days running analyses on samples that were taken at various depths and locations in the pot, and found the aluminum concentration to be relatively uniform throughout the entire mass. However, I will agree that the type and location of heat source would have considerable influence in this respect. This concentration should be kept as low as possible, as an excess will not materially increase brightness.

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If this concentration becomes too high it will not only cut down the weight of coating on the wire, but will affect the deposition of chrome as well. Chromates can be catalyzed to the extent that they will lay down a substantial amount of chrome even on high aluminum alloy. In that event if the aluminum content then becomes too low the chromate may darken or tarnish the bright finish on the wire, somewhat.

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In general, both charcoal and asbestos wipes are used in order to produce wire that is as bright as possible. It goes without saying that the water quench must be as near to the wipes as possible to accomplish this result. In most cases these asbestos plugs are soaked in mineral oil. In that event, until burned out, this oil will deposit a film on the wire that will prevent full deposition of chrome. Then, too, if the wiper used the oil-can quite freely it wouldn't help this condition any. We have found that these asbestos plugs, if soaked in a water soluble oil, will not have this effect on the wire to as great an extent. As far as brightness is concerned, the water soluble oil appears to be as effective as the mineral oil.

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For best results the temperature of the wire, as it enters the chromate, should be such that it will automatically keep it between 140° and 160° F. This is accomplished by regulating the amount of water sprayed on the wire between the wipes and chromate tank. This will depend to a large extent on the size of the wire being processed. The maximum temperature at which the wire should be permitted to enter the chromate is about 250° F. Even at this temperature the heat will force the chromate away from the wire for part of the immersion time and it may be necessary to resort to the use of cooling coils in the chromate tank.

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As the immersion time in the chromate is somewhat critical, it would be necessary to have adjustable rollers, if a wide variation in wire sizes are to be run on the same frame. For wire traveling at speeds according to their gauge, these rollers should be so spaced that the immersion time is no less than 3 seconds and not more than 6 or 7. The peak of chrome deposition is reached at 5 seconds and then begins to taper off. Just a word at this point as to the economy of chromate usage. It is advisable that the water rinse tank, following the chromate tank, be somewhat higher in elevation. In this type of setup the wire will leave the tank at such an angle that the chromate has a tendency to run back into the tank, rather than be carried over into the water rinse. If this factor is not considered when engineering an installation, the cost of drag-out could easily be greater than consumption. In most types of chromates the amount of chrome deposited is increased in almost direct proportion to the increase in agitation. The type here referred to is an exception to this rule, as vigorous agitation has a tendency to retard the deposition of chrome. Therefore, in running light gauge wire at relatively high speeds it becomes necessary to control more closely other factors that influence the deposition of chrome, if maximum protection is desired.

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As pointed out previously, the temperature at which the chromate is permitted to operate is important. Generally speaking, as the temperature of any chromate goes up within its working range, likewise does the deposition of chrome. The one with which we are concerned here is no exception to that rule, up to a certain point. The lowest practical operating temperature is 130°F. If the pH is held within the desired limits of from 1.5 to 1.75 the deposition of chrome will increase in a straight line with an increase in temperature from 130° to 150°F. At this point, as the temperature continues to increase, the deposition of chrome will begin to drop off and at 170°F. the deposition will be about the same as it is at 130°F. There is also an exception to this pattern whereby if the pH value is held at 1.25, the deposition will increase in a straight line from 130° right on up to 170°F. However, experience has proven that when cost is a factor, and it always is, the additional protection obtained will not compensate for the additional chromate concentrate required to hold the pH at that value.

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The concentration of chrome in the bath has little or no effect on the deposition of chrome on the wire as long as the tri-hex ratio is held within reasonable limits. This particular chromate is made up new at 3% with concentrate. At this concentration the hex-chrome will be about 4.8 gr/liter and the pH about 1.5. For upkeep the bath is controlled by holding the pH at the desired value by the addition of concentrate only. As wire is being processed, there is a small amount of zinc dissolved in the chromate thereby reducing some of the hex-chrome to the trivalent state. This hex to tri ratio should not be permitted to get much lower than seven to one. On the surface it may appear to be a difficult chromate to operate. On the contrary, it is quite simple, as the concentrate is so compounded that when a sufficient amount is added to keep the pH between 1.5 and 1.7 sufficient chrome is automatically added to not only replace that

(*Please turn to page* 809)

Development of Aluminum-Clad Copper Wire

by C. L. Carlson
Materials Engineer
Materials Engineering Department
Westinghouse Electric Corporation
East Pittsburgh, Pennsylvania

A paper presented at the Buffalo Regional Meeting of The Wire Association on May 1, 1958, at Buffalo, N. Y.

Satellites, rockets, and missiles are kept constantly before us by the daily press. Radio and television programs devoted to arousing the common man to an awareness of Things-of-Science have appeared almost promiscuously. The present-day demand for elevated-temperature conductors is probably a direct result of the almost feverish activity flourishing around refinement of these space vehicles as well as of the more prosaic aircraft of today. However, several years ago, when the space-age, we have but recently entered, was still but a dream of science fiction fans, the need for elevated-temperature conductors was foreseen. A development program was then started to procure a quantity of aluminum-clad copper wire as a first step toward the long-range goal of providing satisfactory electrical conductors for elevated-temperature service.

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It had been found that copper wire, even when coated with promising high temperature insulations, oxidized excessively at temperatures of from 250°C (480°F) to 300°C (570°F). Aluminum wire, whether coated or not, does not suffer similar degradation. The literature [1]* reveals that during heating in air at 500°F (260°C) over a one-year period, bare copper wire loses cross-sectional area continually due to oxidation while bare aluminum wire retains its size and its conductivity. The difference in behavior is due, of course, to peculiarities of the respective oxides formed. Copper, upon oxidation, acquires a loose, brittle scale that cracks readily permitting further oxidation to proceed apace. Aluminum, on the other hand, forms a tight adherent oxide layer that grows rapidly to a typical thickness and thereafter remains inert.

★ ★ ★

There are silicone-base enamels available that will outlast copper conductors under trying conditions of elevated-temperature operation. These enamels, however, are not impervious to atmospheric oxygen which consequently promotes progressive oxidation of the copper to cause eventual failure of the insulation as well as the conductor.

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The thought that enameled aluminum wire should be used was one of the first reactions to this problem of conductors for elevated-temperature service. Due to space limitations and power requirements of most standard lines of electrical equipment, such direct substitution is not attractive. The relatively high conductivity of aluminum-clad copper wire coupled with its excellent resistance to oxidation are attractive advantages for elevated-temperature use. In addition, certain high-temperature insulations adhere more readily to aluminum surfaces than to copper surfaces. [2]

Manufacturing and Fabrication Methods

Efforts to find a commercial source of aluminum-clad copper wire were completely unsuccessful. After wide-spread search, it was concluded that our own effort was required to produce the desired wire. A 100-pound lot of 0.045-inch diameter wire having a surface amenable to satisfactory enameling by standard procedures was set up as an immediate goal. This goal was finally attained after developing and trying a number of possible production methods.

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Casting aluminum around a copper core appeared to be an ideal method but was found to be unsatisfactory, due primarily to poor bonding between the metals. Casting has not, however, been ruled out as a possible production method. Hot dipping of both copper wire and of copper bar in an aluminum bath was also tried, but the rate of solution of copper in aluminum is very high above the melting temperature of aluminum resulting in very uneven interface as well as surface. Although a small quantity of 0.045-inch diameter wire was obtained by this procedure, the surface quality was not nearly good enough to warrant enameling. This method, like the casting method, shows some promise of success after further development. The method used to produce the desired quantity of high-quality adequately surfaced wire was the tube method wherein a silver-plated copper rod inserted into a properly-sized aluminum tube was drawn to the desired size.

Barrier Layers

The silver plating mentioned is used as a barrier layer between the aluminum and the copper to prevent the rapid mutual diffusion which they normally undergo at slightly elevated temperatures. Many other barrier-layer metals were tried but none performed so well as silver. Figure 1 gives an indication of the reason for silver's good performance as a barrier layer. Its work-hardening rate lies between those of aluminum and

* List of references is appended.

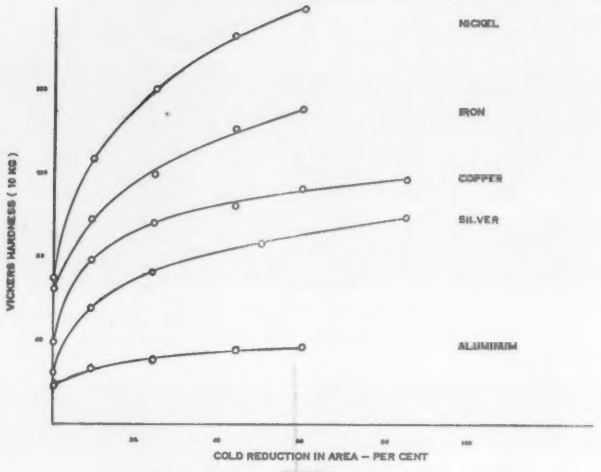

FIGURE 1

CURVES ILLUSTRATING INCREASE OBTAINED IN HARDNESS UPON COLD REDUCTION. CURVE FOR ALUMINUM–MANGANESE ALLOY USED IN ALUMINUM–CLAD COPPER WIRE DEVELOPMENT WOULD LIE NEAR THE SILVER CURVE GIVEN HERE. (FROM H. SCOTT WESTINGHOUSE RESEARCH LABORATORIES.)

copper. Iron is not as satisfactory a barrier layer metal as is silver. This fact is suggested by its rate of work-hardening as shown in this figure. Nickel causes difficulty because of its more rapid rate of hardening. Indeed, the nickel hardens so quickly that it fragments and then causes a bumpy surface on the aluminum which subsequently siezes in the die. This in turn causes the cladding to sleeve off.

Oxidation and Diffusion

Many interdependent factors have been involved in experimental production of this new material—aluminum-clad copper wire. Of primary interest are the peculiarities of oxide formation mentioned before as well as the effects of mutual diffusion of these components into one another. Almost all of the fabrication problems encountered were directly related to either or both of these factors.

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Fundamentally, oxidation is dependent upon the process of diffusion. Copper oxide grows by diffusion of copper through the copper oxide layer to the surface, where interaction with oxygen builds up the oxide layer. This process decreases the diameter and consequently, the current-carrying capacity of the copper wire which in turn causes overheating, accelerated oxidation and eventually, failure. Oxidation of copper continues until the copper is consumed. Oxidation of aluminum contrariwise is a self-limiting process. Aluminum oxide forms extremely rapidly on freshly-cleaned aluminum surfaces, grows apace, but upon reaching a critical thickness of about 70 millionths of an inch, undergoes a crystallographic change which markedly increases the resistance of the oxide layer to further penetration by oxygen. Since aluminum is fundamentally a very active metal, this mode of oxidation is one of its most important characteristics.

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Copper and aluminum diffuse into one another under various conditions of time and temperature. As with all binary alloys of metals forming brittle intermetallic compounds, the diffusion layer which is formed contains the compounds shown in the binary phase diagram for the metals. The copper aluminum diagram shows five intermetallic compounds. Depending upon the extent to which diffusion proceeds, one, two, or all of these compounds are easily visible when the structure is examined under a microscope. Another property of diffusion alloy layers is that they are generally harder than their parent metals.

Insulation

As mentioned before, successful application of various types of insulating enamel was one of the criteria of satisfactory wire. Material finally obtained could be readily enameled. In addition, anodizing this composite wire can be readily accomplished continuously and although the use of an anodized coating, as a dielectric, is not yet established, some low-voltage applications might encourage its development.

Joining

The chief problem in any electrical use of aluminum is to join it satisfactorily to itself as well as to other materials. Several methods can be used with aluminum-clad copper wire to insure a mechanically strong and electrically sound joint. Experiments have proved the feasibility of the crimp type joint for use in motors. Pres-

TABLE I

PROPERTIES OF ALUMINUM-CLAD COPPER WIRE

PREPARED BY THE TUBE METHOD AND USING A SILVER BARRIER LAYER

LOT F

No.	Condition	Ultimate Strength Psi	Yield Strength .1% Offset Psi	Elongation Per Cent In 8"	Flexibility Test No. of Cycles To Fail Over Indicated Radius .50 Inch	.25 Inch	.10 Inch	Flat Bend Test	Conductivity Per Cent IACS°
1	As Received	27200	13200	26.6	47.0	15.5	6.5	OK	83.6
2	As Received	27600	13000	28.5	34.5	15.0	6.5	OK	- - -
3	Aged 1 Month At 200 C	27150	10300	26.6	37.5	14.0	7.0	OK	82.4
4	Aged 1 Month At 200 C	26100 *	10450	24.6	34.0	15.0	6.5	OK	- - -
5	Annealed 0.045" Copper Wire	35050	12750	32.3	25.0	10.0	6.0	OK	101

* Wire Broke In Grips.

° International Annealed Copper Standard Is 100 Per Cent.

Introducing

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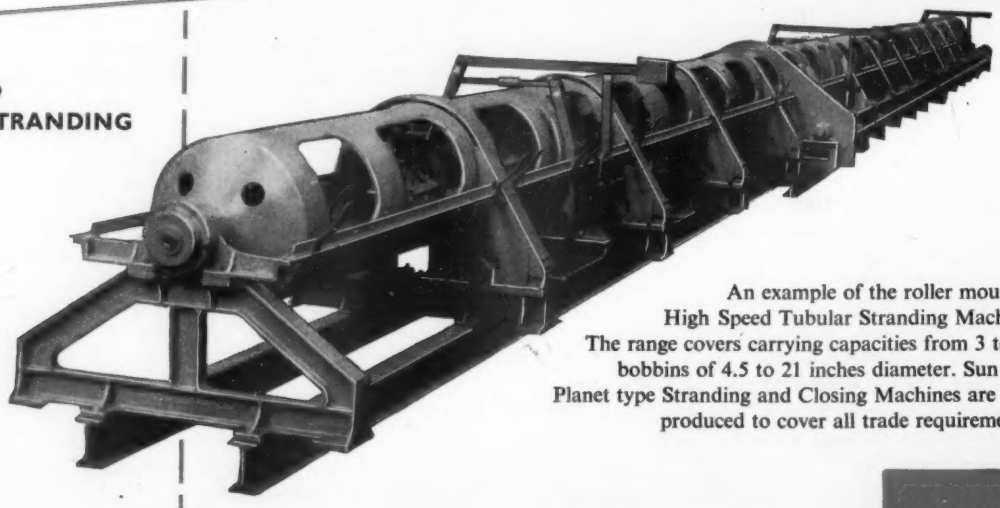
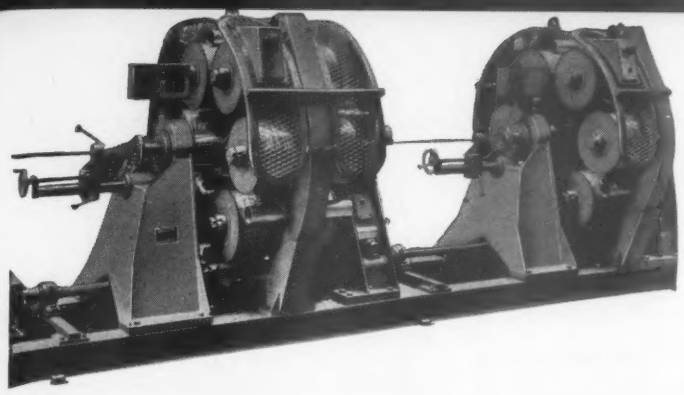
Larmuth & Bulmer of England have been manufacturing rope and cable-making machinery for more than half a century. During this time their skill and experience have produced high quality machines which are used throughout the world today. Now this craftsmanship has been combined with the production resources of a group of British Engineering Companies to provide an export spares and delivery service in keeping with the high standard of their machines. Coupled with this service is the recognition of the need of new machines to meet the growth of the Industry.

HIGH SPEED TUBULAR STRANDING MACHINE

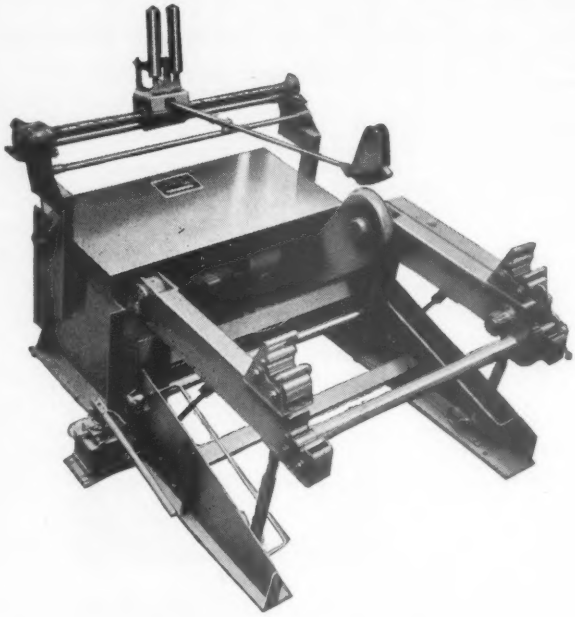


An example of the roller mounted High Speed Tubular Stranding Machine. The range covers carrying capacities from 3 to 45 bobbins of 4.5 to 21 inches diameter. Sun and Planet type Stranding and Closing Machines are also produced to cover all trade requirements.



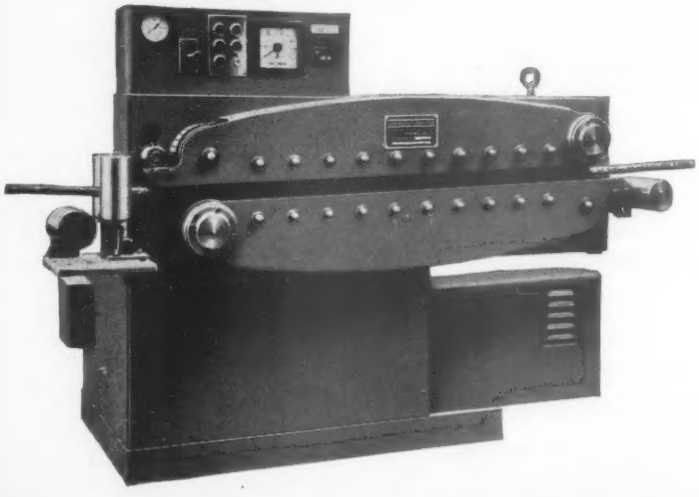
FIXED BOBBIN STRANDING MACHINE

The Larmuth & Bulmer Fixed Bobbin Stranding Machine produces high quality stranding at 50% higher speeds than the Sun and Planet method. Initial costs are low. Floor space is saved. Maintenance is reduced. Many automatic refinements are introduced.



INDEPENDENT TAKE-UP DRUM STAND

This Larmuth & Bulmer independent Take-up Drum Stand can be transported from one machine to another. A new traverse action automatically coils without the aid of the usual standby labour. Cable tension and stop mechanism is electrically controlled to dispense with the friction clutch method. Loading is eased by a hydraulic system.



CATERPILLAR HAUL-OFF

The Caterpillar Haul-Off uses endless belts of rubber shoes which fully protect the cable during haul-off. Grip may be pre-selected and simply controlled. It is positive and constant throughout operation. The unit does not require special foundations or the usual haul-off drum pit. It can be used as a reliable independent measuring device.

LARMUTH & BULMER LIMITED

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Works: Todleben Works, Unwin Street, Salford 6, Lancashire, England

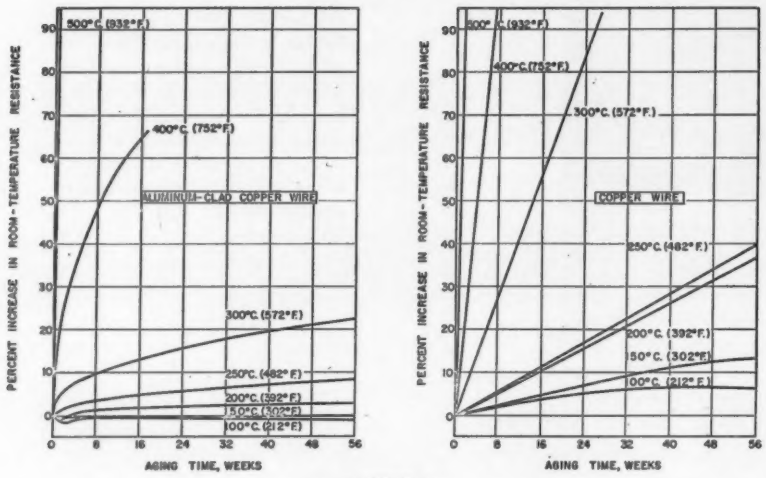

FIGURE 2

PERCENT GAIN IN ROOM-TEMPERATURE RESISTANCE OF 1000 FEET OF BARE 48-MIL DIAMETER ALUMINUM-CLAD COPPER WIRE AND OF BARE 45-MIL DIAMETER COPPER WIRE AFTER AGING AT INDICATED TEMPERATURES. NORMAL RESISTANCE OF 1000 FEET OF EACH OF THESE WIRES IS 5.100 OHMS.

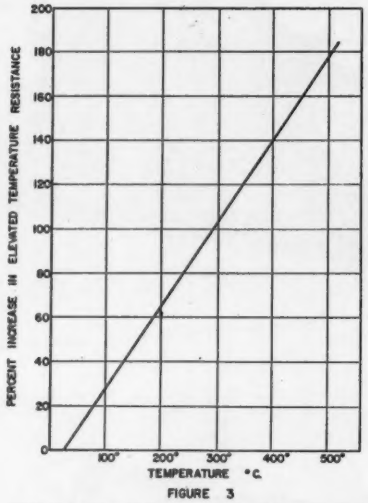

FIGURE 3

PERCENT GAIN IN RESISTANCE OF 1000 FEET OF 48-MIL DIAMETER ALUMINUM-CLAD COPPER WIRE AND OF 45-MIL DIAMETER COPPER WIRE AT ELEVATED TEMPERATURES. NORMAL RESISTANCE OF 1000 FEET OF EACH OF THESE WIRES IS 5.100 OHMS.

TABLE II

PER CENT INCREASE IN ROOM TEMPERATURE RESISTANCE UPON AGING AT INDICATED TEMPERATURES FOR ONE YEAR

Aging Temperature	Aluminum-Clad Copper Wire 48-mil diameter--1000 feet*	Copper Wire 45-mil diameter--1000 feet*
25°C (77°F)	0.0%	0.0%
100°C (212°F)	- 1.0%	+ 6.0%
150°C (302°F)	0.0%	+13.0%
200°C (392°F)	+ 3.0%	+39.0%
250°C (482°F)	+ 7.0%	+77.0%
300°C (572°F)	+22.0%	>600%
400°C (752°F)	>600%	>600%
500°C (932°F)	>600%	>600%

*Normal resistance 5.100 ohms.

TABLE III

PER CENT INCREASE IN RESISTANCE AT ELEVATED TEMPERATURES

Temperature	Aluminum-Clad Copper Wire 48-mil diameter--1000 feet* And Copper Wire 45-mil diameter--1000 feet*
25°C (77°F)	0
100°C (212°F)	29
150°C (302°F)	48
200°C (392°F)	66
250°C (482°F)	85
300°C (572°F)	104
400°C (752°F)	141
500°C (932°F)	178

*Normal resistance 5.100 ohms

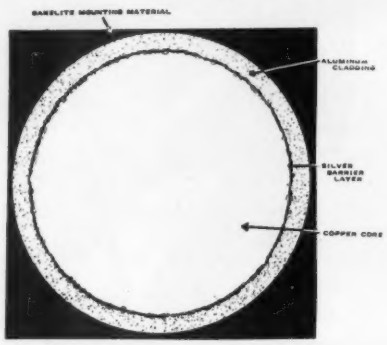

FIGURE 5

CROSS-SECTION VIEW AT 100 DIAMETERS OF 48-MIL DIAMETER ALUMINUM-CLAD COPPER WIRE. NOTE SILVER BARRIER LAYER BETWEEN CORE OF COPPER AND CLADDING OF ALUMINUM.

sure welding offers attractive possibilities in that it, like the crimp joint, is entirely mechanical involving no heating or fusion welding. A carbon-arc, battery operated or rectifier operated, can melt the ends of twisted wires to form the electrical contact. The necessary mechanical strength is obtained with the twisted wires.

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EFFECT OF ELEVATED TEMPERATURES ON BARE ALUMINUM-CLAD COPPER AND BARE COPPER WIRE

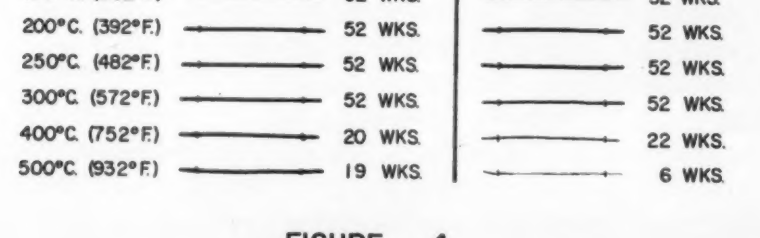

FIGURE 4

Properties

Table I gives actual test results that were obtained at room temperatures before and after aging at 200°C (392°F) for a month. Aging tests in air were begun some time ago to determine the extent of permanent damage suffered by this new wire compared to copper during various periods of time at various temperatures. Preliminary results of these aging tests were published about a year ago. (3)

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Figure 2 and Table II show results of continuation of such aging tests up to one year. The calculated per cent increase in resistance of 1000 feet of 48-mil diameter bare aluminum-clad copper wire is compared to that of 45-mil diame-

(*Please turn to page* 809)

Heavy Tinned Copper Wire for Electrical Conductors

by

L. A. Kent
Assistant to the President

and

J. F. Mahon
Sales Manager

Camden Wire Company, Inc.
Camden, New York

The authors prepared this paper for delivery at the Buffalo Regional Meeting of The Wire Association on May 1, 1958, at Buffalo, New York.

During the past decade the demands of automation have effected many changes in the wire industry. The most radical product change in the uninsulated wire segment of the industry is the heavy tin coating of individual wires.

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It has always been the function of wire fabricators to supply tinned copper conductors. Therefore, when a need for heavy tin coating was established, it was natural that the electronic manufacturers and insulated wire manufacturers would look to their suppliers as a source for this material.

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It would be difficult to say how old the idea of heavy tin coating is. The problem was originally presented the Camden Wire Company by a resistor manufacturer who required additional tinning on the intermediate range of copper wire, AWG 16 through 24, to eliminate hand operations. This customer found that commercially tinned copper wire had to be hand dipped in solder before assembly. He believed that a heavier tin coat would eliminate this step.

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A more recent and challenging development is the demand for heavy coated stranded conductors by the appliance wire manufacturers and the radio hook-up wire producers. They require a stranded wire which is capable of being bonded at the terminal ends, but will at the same time be flexible and concentric.

These users employ high frequency generators in conjunction with their cutting and stripping apparatus. If sufficient tin is present on the individual wires making up the strand, and if the wires are properly laid up, the cable will bond into a solid mass at the precise point where induced heat is applied, thus preventing fraying when the stripping machine exposes the conductor at this point, leaving it ready for soldering without further processing.

★ ★ ★

At our plant the "hot dip" method of tin coating is used. This means that properly prepared bare copper wire is conducted through a rigidly controlled bath of molten tin. The same basic principle with modifications is employed in the production of heavy tin coated copper wire.

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In the resistor wire range, AWG 16 through 24, an average minimum wall thickness of coating of .00025 can be maintained. This thickness has been found to be sufficient for soldering and has been instrumental in increasing production and reducing costs in this type of manufacture.

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In the newer process, the coating of wire to be used in stranded conductors, the most common sizes used are from AWG 25 through 36. Here an average wall thickness of tin of .00015 inches is prescribed for sizes AWG 25 through 30, and .00010 inches for sizes AWG 31 through 36. We have adopted this specification and several trade associations, among them the Electronics Industries Association, are currently considering it.

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These tolerances of coating have proved sufficient to meet the bonding requirement, and have also speeded up the soldering operation. In all cases it has been found that less solder is required, and some manufacturers by use of a high speed gas flame have found that no solder at all is required. Others report that resistance soldering is greatly enhanced.

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In the manufacture of critical audio wire, it has been found that the additional tin coat has improved performance by preventing resistance due to oxidation.

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While sufficient tin is a prerequisite to proper bonding, it is also extremely important that wires be stranded in such a manner as to permit the induction heat to penetrate the cable uniformly. New stranding techniques favorable to this application and yet maintaining the necessary concentricity and flexibility are being employed.

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Adequate tinning and proper stranding are the basic elements. To achieve acceptable bonds, consideration must be given to heat-time factor, the use of proper

(*Please turn to page* 810)

Aggressive Product Development—For Leadership

by Leo M. Elijah
Senior Engineer
Parts Division
Sylvania Electric Products Incorporated
Warren, Pennsylvania

A paper presented at The Buffalo Regional Meeting of The Wire Association on May 1, 1958, at Buffalo, N. Y.

In a rapidly advancing economy, ever conscious of the necessity to keep ahead in technology, we have all been made to realize that over confidence is deadly and immobility fatal.

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An old quotation which states "To Stand Still is to Move Backwards" is far more valid today in our nuclear age, than had been in the stone or iron ages.

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Industry is built upon competition. For any corporation to stay in business, costs must be maintained at a minimum and sales appeal at a maximum. Indirectly, both competition as well as its direct result, sales appeal, are responsible for accelerating industrial progress. Naturally, we are always turning to materials that are better or more improved, and at the same time less expensive—for example, wires with greater strength or greater corrosion and heat resistance or higher conductivity or some other special property or combination of properties.

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Few people realize the fact that a major portion of our present business is based on products which were not even on the markets as little as ten years ago, almost unknown fifteen years ago.

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Sylvania's leadership in wire production and the industry is due generally to its advanced research and developmental facilities, initiated and guided by its farsighted management.

The current rate of advance of science has caused distances to atrophy and current markets to be rapidly obsoleted. To keep in business today, a corporation has to strive constantly to be on the top by switching from outdated, outmoded products and techniques to better and more advanced designs and methods, or be forced out of the market.

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However, before a corporation can commence to develop new products, a wide complexity of factors have to be considered and evaluated.

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Initially, new product ideas have to be gathered, but, prior to this, the present problems of the given company should be accurately analyzed. Based on this, new product areas of proven profits and potential competitive advantages must be identified, making sure that explosive markets, technological breakthroughs, fields of advancing profits are clearly earmarked to enable maximum capitalization of existing resources, listing possible methods of exploiting these external growth opportunities. From the results of this survey, a program must be established for planned idea generation. Eventually, ideas should be collected through an organized network of channels.

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It therefore follows that performance of currently produced parts must also be regularly reviewed to eliminate relatively unprofitable lines.

★ ★ ★

The second step requires evaluation of the above ideas, categorizing and filing each one, then discussing them with company specialists, or with outside consultants if considered important enough. Methods should be developed for converting them into business propositions indicating the financial outlay, usage of present manufacturing facilities, distribution pattern, competition expected, risk involved, etc.

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In the third stage, pertinent feasible ideas should be developed and tested by analyzing each step, consumer demand, cost of production, relative merits of competitive products, and final laboratory evaluation. As a result of the findings, possible products should be modified, eliminated, or held for further investigation, incorporating the findings into product design. Successful products at this stage are to be recommended for commercialization, outlining simultaneously a detailed program for production, manpower, budget and sales.

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The final step is the production stage, wherein actual plantwide facilities are employed for the manufacture of a pretested product.

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It should be unnecessary to point out here regarding the necessity for an accurate pre-evaluation of the potential merits of a new product before commencing

actual production to prevent costly failures.

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It is observed that products developed and marketed without prior investigation and market research failed over four times as frequently as pretested products.

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Very often selling a product is more difficult than the problems encountered in manufacturing it. Hence, the products for sale tomorrow have to be developed and investigated not today—but yesterday! Market research has to commence further and further back into the product developmental stages to prevent costly wastage of labor and material later.

★ ★ ★

At our plant in Warren, the possibilities of new products considered are limited only by the imagination. In the highly specialized and very intensely competitive field of wire manufacture, almost every kind of wire has been produced for almost every different type of application. Composites of two different metals or alloys and also three tyre composites are being fabricated as required.

Property Requirements

Wire has numerous uses and a wide variety of applications. Directly or indirectly, we are constantly utilizing a complex diversity of wire products. A spring chair or mattress, a watch, the telephone, refrigerator, television, radio, etc. are some of the more widely known uses. Every day newer and more specialized properties are demanded of it, in the ever-widening fields of atomic research and missiles.

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Specifically, every product has one essential factor, namely, low cost. However, for wire, one or more of the following characteristics are also required in its usage:

(a) Mechanical properties — for example, high strength or ductility.
(b) Electrical conductivity or resistivity characteristics.
(c) Mechanical and/or electrical requirements at elevated temperatures.
(d) Electronic applications as for grid wires, siderods, leads, and for radio tubes.
(e) Catalytic characteristics of certain metals used in cracking of oils, gases, etc.
(f) Resistance to the effect of corrosive fluids.
(g) Appearance, low weight or similar physical properties.
(h) Glass sealing characteristics.
(i) Other specialized requirements—high frequency applications.

Manufacturing Wire for Specialized Requirements

Various types of wire are being developed and manufactured by Sylvania at Warren, Pennsylvania. Particular emphasis is placed on specialized applications involving close dimensional, mechanical or quality tolerances, with regard to composite wires, wherein the advantages of both kinds of materials can usually be incorporated into one unit.

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As is obvious, the outer sheath, whether clad or plated, must be unbroken, free from burrs, deep pits, deep scratches, and other foreign inclusions for optimum performance.

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A description of the types of combinations developed for particular applications is outlined below.

A) Applications Requiring Mechanical Characteristics

In medium strength applications, low carbon steels are employed in the as-drawn condition. For higher strength applications, medium and high carbon steels are used.

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Steel wires find wide and extensive applications for a variety of useful purposes at home and in industry, such as music wire, springs, nettings, wire rope, meshes, wire fences, etc., and in almost any application where cheapness is required, together with a fair or high degree of strength.

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Alloy steels, together with their inherent high mechanical strengths, also have a high resistance to atmospheric and corrosive liquid attack.

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The following alloy steels can be processed down to .002″ diameter: Nos. 203, 302, 304, 305, 321, 420, 430 and 446 types in solid wire form (as opposed to the composite variety) for application generally as braid wire, since they develop high strength in the cold worked condition in addition to their oxidation resistance properties mentioned previously.

★ ★ ★

Nos. 203, 302, 304, 305 and 321 steels belong to the austenitic group. As they develop considerable strength, they cause excessive die wear requiring the use of special techniques.

★ ★ ★

A special steel, which falls in this group and is similar to the 203 Grade, had been a little more difficult than the other steels of this category, in that it is a low Nickel (0.50% max), high Manganese (15.0-16.0%), high Chromium (13.5-14.5%), Copper bearing (1.5-1.8%) steel. It is particularly hard on die life, since it has a higher tensile strength in the annealed condition and embrittles more readily than average alloy steels, possibly due to its higher work hardening rate. By developing special procedures, it was produced in a range of tempers up to 310,000 psi in the cold worked condition with sizes to .010″ diameter.

★ ★ ★

Nos. 420, 430 and 446 are of the ferritic type of stainless steels and may also be employed as braid wire or where the wire undergoes tension at elevated temperatures and/or corrosive atmospheres are present.

★ ★ ★

In the electronic industry where oxidation resistance is required along with rigidity and cheapness, nickel plated low carbon steels are produced extensively in sizes from .002″ to .250″ diameter for use as siderods, leads, etc. Some low carbon steels are used directly as mandrel wire.

B) Electrical Conductivity

For high conductivity wire, copper is the most logical choice. Although it has a slightly higher resistance than silver, it is quite close to silver, being considerably cheaper and having a higher melting point (1981°F), but copper oxidizes fairly rapidly at elevated temperatures causing a rapid deterioration of conductivity with time.

★ ★ ★

Silver, on the other hand, together with its higher cost, has a lower melting point (1761°F), hence, a smaller working range. For this reason, copper is usually clad with other metals as outlined below.

★ ★ ★

Aluminum also has good electrical conductivity in the pure condition. It is almost 65% that of copper on an equal volume basis and 213% on an equal weight basis (at 70°F), but it has a comparatively low melting point (1220°F) and so far it has been difficult to solder or weld, hence, aluminum is copper plated. Copper Plated Aluminum is used extensively in both sheet and wire form. Recently though, special soldering and welding techniques for bare aluminum have been developed.

★ ★ ★

The high conductivity to weight ratio of aluminum is used in combination with copper. Both Aluminum Clad Copper and Copper Clad Aluminum have been made in various cladding percentages and sizes down to .010" diameter.

C) Electrical and Mechanical Requirements at Elevated Temperatures

This field of investigation has been the most prolific for the creation of new alloy combinations.

★ ★ ★

By definition, an ideal conductor for operation in a higher temperature range must have a low initial resistance, with the assurance that a continued high conductivity level will be maintained over a period of time.

Normally, in composite wires of this type, the desired strength and oxidation resistance features are donated by the outer sheath, high electrical conductance is accomplished by the core.

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Some of our more notable developments are described below.

(1) 10% Nickel Plated Copper

This material has been developed as an electrical conductor where intermediate temperatures up to 700°F, oxidizing conditions and corrosive atmospheres exist. As may be evident, the composite wire has an electrical conductivity slightly greater than 90% that of a solid annealed copper wire. Sizes from .250" to .005" diameter have been made in the hard, semi-hard, or soft condition.

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It is produced by electrolytically plating copper rod at .250" diameter with 9-10% nickel by weight. This is cold drawn and annealed in stages, resulting in a continuous protective layer of nickel over copper. The plating has high density characteristics, giving additional assurance of protection within the temperature range.

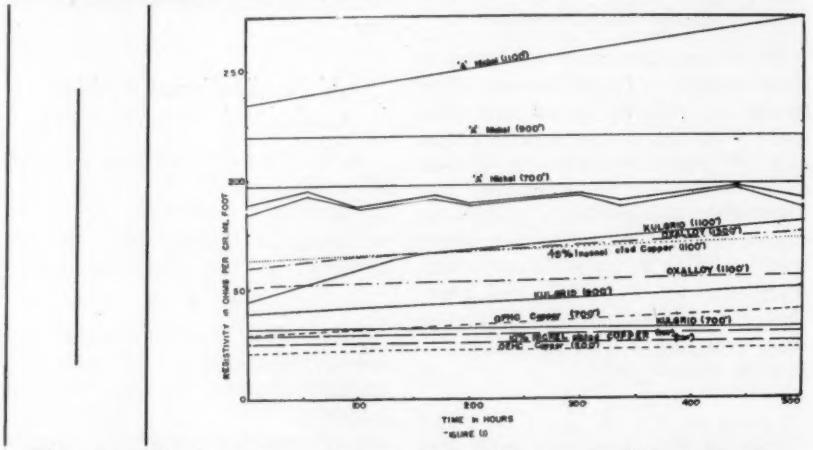

Fig. 1 indicates the relative resistivity of this material at 700°F compared to that of OFHC Copper, "A" Nickel, etc. showing its obvious superiority over the latter two at this temperature. Initially, OFHC Copper at 500°F has slightly lower resistivity. However, with the passage of time, the resistivity continues to increase, that of 10% Nickel Plated Copper staying fairly constant.

★ ★ ★

Its superiority is evident over the commonly used electrical conductors having high conductivity and good mechanical characteristics in the whole range up to 700°F. It is cheaper in the long run, both with regard to cost of the materials currently being employed, and in the lower cross-sectional area required to conduct a given current at the intermediate temperature range, together with its ability to withstand corrosive atmospheres.

★ ★ ★

It is used as a conductor for a lead-in wire to various types of electrical heating and electronic equipment. Also, as a heating element wire for low temperature heating requirements — for example, the special chamber in a refrigerator which keeps butter soft and readily usable.

(2) Kulgrid 28

Sylvania's designation for 28% Nickel Clad Copper wire is Kulgrid 28. It was developed for applications as an electrical conductor where medium-high temperatures up to 1000°F and atmospheres (oxidizing or corrosive) to copper exist. It has a range of usage varying from .300" to .0035" diameter in either the hard or soft temper.

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Cladding is performed in the standard way by inserting a copper rod into a nickel tube, then through successive stages of reduc-

tions and anneals, reducing it down to the required size.

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The material is widely used in the aviation industry where weight is important. The weight of Kulgrid 28 required to carry a given amount of current is considerably less than if solid nickel wire was employed. In the case of OFHC Copper, the electrical conductivity rapidly deteriorates at elevated temperatures over 400° to 500°F after a period of time which, therefore, precludes its use over that range.

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Kulgrid 28 is used as lead-in wires to heating elements in electrical resistance furnaces, electrical appliances and vacuum tubes, as hook-up wire in induction furnaces and other electronic equipment, wherein its ability to withstand elevated temperatures, corrosive and oxidizing atmospheres can be utilized.

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Other percentages of a cladding up to 90% nickel have also been produced.

(3) Inconel Clad Copper

This combination is manufactured using a copper rod and an inconel tube (Nickel-chromium-iron alloy manufactured by The International Nickel Company, Inc.), then reducing the diameter in a similar manner to that outlined under Kulgrid 28.

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It is produced from .250″ to .005″ diameter and used up to a temperature of 1000°F (Fig. 1) under ordinary atmospheric conditions, and those detrimental to both copper and nickel.

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Investigation is being continued along the above lines towards obtaining a wire combination with the maximum possible electrical conductivity which can be maintained at higher temperatures and suffers little or no decrease with the passage of time.

(4) Oxalloy 28

Another development which is more recent and yet in wraps is also employed as a high temperature electrical conductor for applications up to 1200°F. Oxalloy 28 is Sylvania's designation for copper wire, clad 28% by weight with a chrome-iron alloy. Initially it has a slightly higher resistivity (Fig. 1) than either 10% Nickel Plated Copper, Kulgrid 28, or OFHC Copper at room temperature. However, at 1100°F, its resistivity levels off and becomes lower than any of these after a few hours at temperature.

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It has been manufactured in sizes from .250″ to .005″ diameter, in either the hard, semi-hard or soft temper, bright or dull finish depending on application and requirement.

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This material is expected to be used widely in applications requiring a consistently high level of conductivity without considerable deterioration at temperatures up to 1200°F.

D) Electronic Applications

(1) "A" Nickel, "D" Nickel, "Perma" Nickel and "Dura" Nickel are all used where the emissivity, conductivity, higher melting point and other desirable properties of nickel and its alloys are employed to best advantage, as in grid lateral wire for radio tubes. Diameters down to .0015″ are being produced as required.

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(2) Nickel Plated 1005 Steel and Armco are used for siderods, leads, etc. owing to the inherent strength and cheapness of the base material (steel) combined with the oxidation resistance properties of the external nickel plate. Standard drawing procedures for plated material are employed to yield sizes from .002″ to .250″ diameter.

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Bare Armco is also drawn to finer sizes and utilized for mandrel wire.

E) Catalytic Applications

Precious metal or alloy combinations with a tough, strong core like steel or phosphor bronze may be obtained either by plating or cladding. Uses include the chemical or petroleum industries for catalytic oxidation, reduction, or other chemical reactions involving cracking of petroleum, etc., through wire sieves or nettings. Catalytic action offers a wide field of application that so far has been incompletely explored.

F) Resistance to Corrosive Fluids

Gold plated stainless steel tubing has been employed for atomic energy applications where the composite tube is employed as a heat exchanger; the exchange taking place between an extremely corrosive and a slightly corrosive fluid. The bare stainless surface being resistant to the slightly corrosive fluid is directly in contact with it. The gold coat on the other side faces the heat transfer media corrosive to stainless. The gold is plated thinly and evenly onto the stainless surface, drawn to the required diameter and employed directly.

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The electronics' industry also employs precious metals and alloys, clad or plated on copper or nickel, where high conductivity of the base material must be protected against corrosive atmospheres.

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Inconel Clad Nickel, wherein a nickel core is clad with inconel as a sheath in sizes as fine as .005″, is employed in atmospheres which would be detrimental to nickel.

G) Appearance and Other Physical Property Requirements

Where appearance is important, nickel, chromium, silver, gold or any other metal or alloy is plated on another less presentable material depending on application, etc. For lightness, aluminum is normally employed. Stainless steel may also be clad on for appearance, high temperature properties, toughness or other desirable physical properties.

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However, as mentioned before, every product normally has at least

(*Please turn to page* 811)

The Buffalo Regional Meeting

The Wire Association's calendar was signalized on May 1 and 2, 1958, by the holding of an outstandingly successful Regional Meeting at the Statler Hotel in Buffalo, New York.

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The registration desk opened at 9:00 o'clock on Thursday morning. Some 249 persons registered for the affair, about equally divided between the Ferrous and Non-Ferrous Divisions, the Non-Ferrous Division's Electric Wire and Cable Section, if anything, having a little of the edge in attendance.

Semi-Annual Meeting of the Board of Directors

The meeting was called to order by President **Tom M. Girdler, Jr.** at 10:15 o'clock on May 1st.

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Mr. Girdler announced that as **S. Ray Snow** had resigned since the October meeting, he had appointed **Walter B. McShane,** Chairman, Wire Committee, **American Steel and Wire Div., U. S. Steel Corporation,** to take his place. He was officially welcomed to the Board by the President.

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Richard E. Brown, Executive Secretary, was called upon to read the minutes of the previous meeting and give the semi-annual report of the Secretary-Treasurer. Both were approved as read.

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Fred A. Webber, Chairman of the Program Committee for the Buffalo Regional Meeting, reported that they had secured ten technical papers, that plant inspection trips to Wickwire - Spencer's Buffalo plant and to Western Electric's plant had been arranged, and that for the banquet **Dr. Everett T. Wellmers,** Long Range Planning Director of the Lawrence D. Bell Research Center, had agreed to give the after dinner talk. A vote of thanks to Mr. Webber and the Committee was spread upon the minutes.

Earl R. Potter's letter to Mr. Brown reporting on the West Coast Regional Meeting in Los Angeles on June 5 and 6 was read, giving the details of the program, which was deemed to be a good one. Mr. Girdler urged that as many as could attend the meeting.

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Raymond S. Worth, General Program Chairman for the Annual Convention next October, gave a report on plans for this meeting. **Dr. Dartrey Lewis,** he said, was to head the Ferrous Program Committee and **Hugo W. Biskeborn** the Non-Ferrous Program Committee. The Ferrous program will have 17 papers and the Non-Ferrous 16, from present indications, although this program had not been completed. Plant inspection trips to Roebling's mills in Roebling and Trenton have been arranged for both Divisions. Discussion of the Stag-Smoker show resulted in a vote to limit the expense for it to $2800.

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Mr. Brown read a report from **David M. Schmid,** Chairman of the Awards Committee, a full account of the selections for Medal Awards and Certificates of Honorable Mention appearing elsewhere in this issue.

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Discussion of places to hold a regional meeting for 1959 resulted in the selection of Houston, Texas, and **William L. Dull,** Superintendent of the **Sheffield Division,** C. F. & I., Houston, stated that they would be glad to have the meeting there. The meeting will be in April, the date, hotel and other details to be decided later. Mr. Dull was appointed Program Chairman.

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Mr. Girdler then appointed as members of the Nominating Committee for Directors: **Charles H. Williams, Jr.,** Chairman, and members, **Frank Ashworth, James E. Flood, W. Roy Mackay** and **Raymond S. Worth.**

For the Nominating Committee for officers, he appointed **Earl R. Potter,** Chairman, and as members: **A. M. Reeder, Ralph B. Roth, John L. Sanderson** and **Marshall Yokelson.**

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For the Nominating Committee for the Executive Committee, he appointed **John H. Corson,** Chairman, and **William L. Dull** and **Benoit J. Sirois** as members.

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Hugo W. Biskeborn was called upon to report on the work of the Electric Wire and Cable Section Committee, and he stated that they had set up a number of subdivisions, would undertake to cooperate with local committees in the formulation non-ferrous programs and had appointed a Papers Review Committee to pass upon papers prior to acceptance. The Electric Wire and Cable Section Committee is now actively engaged in arranging the Annual Convention program in this sphere of interest. He also suggested that due to the many meetings held in the Fall, consideration be given to meeting in the Spring, especially in the electric wire and cable end.

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Mr. Brown reported on a meeting with several top men in NEMA's Electric Wire and Cable Section, in which the broadened activities of the Association were discussed. The meeting clarified to them our objectives, which are to aim our work toward the production problems of this branch of the industry, and all expressed themselves as being satisfied.

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In a discussion following the reading of a letter from a woman who had applied for membership in the Association, since heretofore only men have been members, it was decided it was within the sense of the By-Laws that it was proper to accept such applications, where it was felt that such person could contribute to the advancement of the Association's inter-

ests.

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Following a motion to ratify the acts of the officers and directors for the period covered by the report, which was duly seconded and passed, the meeting adjourned at 12:10 o'clock.

The Technical Sessions

The first meeting opened at 10:30 A.M. on May 1, with two papers of general interest. **Rodman R. Tatnall,** Metallurgist, **Wickwire-Spencer Steel Div., Colorado Fuel & Iron Corp.,** Buffalo, was the Chairman of the meeting.

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The initial paper, presented by **Michael Suba,** Division Manager of the **Bakelite Company,** New York, N. Y., was "Control Pressure of Extrusion Thermoplastic Material." It was concerned not only with coating electrical conductors, but the coating of steel wires and cables.

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L. M. Elijah, Senior Engineer, **Sylvania Electric Products, Inc.,** delivered a paper entitled "Aggressive Products Development—for Leadership," in which he traced the steps that must be taken to develop and prepare a new product for the market.

Ferrous Technical Session

This session began at 2:00 P.M., May 1, with **Charles H. Williams, Jr.,** Superintendent, Rod and Wire Mills, **Pittsburgh Steel Company,** Monessen, Pa., acting as chairman of the meeting.

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S. Fisher, Vice President and General Manager of **National Electric Welding Machines Co.,** Bay City, Mich., led off with a paper on the "Application Aspects of Wire Mesh Welding" in which he described welding techniques, the problems arising from the welding of different metals, and the procedures to follow to secure good welded joints in mesh production.

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William D. Bawden, Wire Mill Consultant to the **Lee Wilson Engineering Company,** Cleveland, Ohio, then delivered a paper on "New Radiant Tube Furnaces for Wire Processing and Patenting," delineating the features of a new type of furnace recently developed.

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"Chromates as Applied to Hot Dip Zinc Coated Wire" was the next paper on the program and was given by **M. S. Siddall,** Service Manager, **Promat Division** of **Poor & Co.,** Waukegan, Ill. This paper provided information on the methods of applying a number of chromates successfully.

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J. S. Laver, Superintendent of Production Scheduling, **Steel Company of Canada Ltd.,** Hamilton, Ontario, gave the last paper, "Rod Packaging," which was a sequel to one on the same subject delivered a year earlier at the Hamilton Regional Meeting. It covered new information and experience gained in the method of tying rod bundles for shipment or storage.

Non-Ferrous Technical Session

While the Ferrous Session was getting under way, also starting at 2:00 P.M., with **W. R. Moyers,** Chief, Wire Engineering Dept., **Western Electric Co.,** Buffalo, serving as Meeting Chairman, four papers were presented.

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The first, "Development of Aluminum Clad Copper Magnet Wire" was given by **C. L. Carlson,** Materials Engineer, Materials Engineering Dept., **Westinghouse Electric Corp.,** East Pittsburgh, Pa. It gave technical and application information on this interesting development.

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W. Scott, Section Manager, and **J. L. Harper,** Materials Engineer, Manufacturing Engineering Dept., **Westinghouse Electric Corp.,** Sharon, Pa., were responsible for the next paper, "Automated Preparation of Stranded Cable for Termination," which proved of interest to many who have had to face this difficult problem.

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J. F. Stoltz, Chief, Wire Engineering Dept., **Western Electric Co.,** Chicago, Ill., delivered a talk describing a new development that approaches automation. The title was "Drawing and Insulating Wire in One Tandem Operation."

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The last paper of the session, but not the least, was "Heavy Tinned Copper Wire for Electrical Purposes," jointly prepared by **L. A. Kent,** Assistant to the President, and **J. F. Mahon,** Sales Manager, **Camden Wire Company,** Camden, N. Y. This paper contributed important information on tinning.

The Banquet

On Thursday evening of May 1, at 7:00 o'clock, those present gathered in the Ball Room for dinner, 250 strong.

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Tom M. Girdler Jr., Association President, welcomed the guests and introduced the speaker of the evening, **Dr. Everett T. Welmers,** Assistant to the President of **Bell Aircraft Corporation,** Niagara Falls, and Long Range Planning Director of the company's new Lawrence D. Bell Research Center.

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Under the title of "Don't Fence Me In" he gave a highly interesting and informative preview of the expanding horizons of missiles, satellites and space travel. Those who heard him were unanimous in their appreciation of this opportunity to hear a man of extraordinary ability and vision.

Plant Inspection Tours

Approximately 90 persons went to see the modernized plant of **Colorado Fuel and Iron Corporation's Wickwire-Spencer Steel Division** on River Road on Friday morning, May 2nd. They were conducted through the plant in small groups. In this integrated plant, which starts operations with the production of pig iron and carries through to the manufacture of a number of wire products, CF & I's guests were able to observe the many changes that have taken

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Association's 1957 Award Selections Made

At the meeting of the Board of Directors in Buffalo on May 1, **David M. Schmid's** report on the award winners for 1957 was submitted to the Board. Mr. Schmid, President of **Techalloy Company, Inc.,** Rhans, Pa., and Chairman of the Awards Committee of The Wire Association stated that the selections for these honors had been made by the Oxford System, which assures impersonal and impartial judgment of the merits of any paper.

★ ★ ★

In The Ferrous Division, the Medal Award winner is **Dartrey Lewis,** Chief Engineer, Research and Development, **John A. Robling's Sons Corp.,** Trenton, N. J., given for his paper, "Combined Hot Rolling and Patenting of Rod."

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In the same Division, **E. Jefferson Crum, R. H. Miller Co.,** Riderwood, Md., was selected for a Certificate of Honorable Mention for his paper, "The Coreless Coil—A New Wire Handling System."

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Awards in the Non-Ferrous Division were assigned to **Clement C. Lawson,** Plant Facilities Engineer, **Bell Telephone Laboratories, Inc.,** Murray Hill, N. J. He will receive the Medal Award in October for his paper, "Buried Distribution of Telephone Circuits."

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A Certificate of Honorable Mention is to be given to **A. A. Defoe,** Chief Engineer, Electrical Conductor Engineering Dept., **Aluminum Laboratories Ltd.,** Kingston, Ontario, for his Non-Ferrous Division paper "Oxide Coatings on Aluminum Wire."

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The Oxford System of judging the merits of papers gives consideration to the following points:

1. **Does the paper have value to the members of The Wire Association as a whole?**
2. **Does it contain new information that has not been published before, or is it a restatement of research material?**
3. **Does it constitute an advancement in knowledge by clarification of past information?**
4. **Does it provide a re-assessment of known facts in such manner as to be understood readily by the industry as a whole?**
5. **Are claims in the paper factually supported with definite, impartial test data and established experience?**
6. **Is the paper valuable as a reference work?**

★ ★ ★

Of all the papers published in **Wire and Wire Products,** only a few, relatively speaking, have been eligible for awards. It is hoped that more will be in succeeding years. Only twenty-two papers qualified for the 1957 awards.

David M. Schmid
Chairman, Medal Awards Committee

The Board of Directors presents each year Medal Awards and Certificates of Honorable Mention to those authors of technical papers and articles given at Association meetings or published in Wire and Wire Products as a donation to The Wire Association which, in their opinion, represent the most meritorious contributions made to the advancement of the wire industry's interests, productionwise.

The first consideration is that authors must be members of **The Wire Association.** The second is that the paper must have been contributed for the benefit of the industry—papers for which authors have been paid are not eligible, however good they may have been. A third is that a paper that has been presented before another society or published in another magazine cannot be considered for awards.

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All papers that are presented at the Annual Convention or Regional Meetings or that have been published in **Wire and Wire Products** without respect to such meetings, are taken under advisement by the Awards Committee.

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At the Annual Convention in Atlantic City when these awards will be made for the 1957 papers, for the first time each award winner will have presented to him an accompanying check for $100.00 and $50.00 for the Medal Awards and Honorable Mention Awards, respectively.

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This additional incentive to those who write papers or articles for us was voted at the meeting of the Board of Directors last October to increase the interest of authors in the possibility of achieving a tangible honorarium in addition to the honor of the award itself.

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All authors of papers are invited to bear in mind the awards that will be made and to so submit their papers that they will be eligible under the rules set forth in an earlier paragraph.

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These awards are a distinct honor and all authors are urged to compete for them.

NEMA'S Wire and Cable Section Holds Annual Spring Meeting

The highlights of this meeting are reported here. The sessions included discussions on current conditions, wire and cable matters and other related subjects.

Recovery from the "current recession will come about slowly, and probably will get underway toward the end of this year," **Dr. Heinz E. Luedicke,** Editor of the **Journal of Commerce,** told more than 100 leading wire and cable company executives at their annual spring convention at Westchester Country Club, Rye, N. Y., on April 30th.

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The meeting was sponsored by the wire and Cable Section, **National Electrical Manufacturers Association,** under the chairmanship of **Vernon W. Heimberger, American Steel and Wire Division, U. S. Steel Corporation.** Moderator for the meeting was **T. E. Veltfort,** Manager of the **Copper and Brass Research Association.**

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Dr. Luedicke predicted that recovery will get underway when "the rise in government spending plus the reversal in inventory policies from liquidation to accumulation more than offsets the decline in plant and equipment spending plus the trend toward the liquidation of consumer debt."

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The speaker declared that housing, later during the year, will give the economy a boost although it will take a few months before the easing in mortgage provisions will be reflected in higher housing starts. Inventories have declined at an accelerating rate since last September. By the end of February they were down $2 billion from their 1957 August-September peak. The actual decline still is smaller than the 1949 and 1954 drops in inventories which started from lower totals. While the rate of decline is bound to slow up soon, there is reason to believe that the swing back to inventory accumulation will not occur until the final quarter, unless conditions force the government into more anti-recessionary policies during the next three or four months. It probably would take an inflationary scare to reverse current inventory policies suddenly or before the final quarter of the year. Unusually the downswing in the inventory cycle takes about a year.

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The decline in plant and investment expenditures is only now getting under way. This is nearly a year after the recession began and more than a year after new appropriations for plant and investment expenditures turned downward. The long lag between new appropriations and actual expenditures is due to the fact that many programs are stretched out so that completions are delayed.

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As matters now stand, plant and equipment spending this year will drop about $5 billion from last year's record peak. It is quite probable that the decline will carry into 1959, although the trend should be reversed before the end of next year.

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The impact of any real decline in consumer spending probably would make the government move in faster with anti-recession measures — probably a tax cut. For this reason, the conclusion now is that any further declines from current levels will be cushioned by more aggressive government policies, but that nothing points to any real improvement before late this year or maybe even next year.

Other Discussions

Leighton Farrar, Director, Management Advisory Services for **Price Waterhouse Company,** also based his discussion on business conditions, cautioning his listeners not to make "haphazard cuts across the board" as anti-recession measures. Actions of this type, he said, often have after-effects which leave organizations weakened to the point of making it difficult for them to regain their former position in the business community when upturns arise.

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W. E. Sprackling, President of **Anaconda Wire and Cable Company,** discussed the wire and cable industry in a declining economy. He noted that earnings in the industry, like those of many other manufacturing industries, have declined severely. He suggested that management should educate all of its employees on the importance of earning a reasonable profit because their long-range job security depends on the business making such a profit. In reviewing problems peculiar to the wire and cable industry, he cited the tremendous variety of new products and insulations now that the "chemical age" has arrived in the wire and cable industry. This large number of products has increased production costs and has created inventory problems. A similar situation has arisen because of the large number of new types of packaging.

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H. H. Watson, Commercial Engineer, Sales Department, Construction Materials Division, **General Electric Company,** reviewed some of the proposals for the next issue of the National Electrical Code which affect wire and cable products, stating that the demand for grounding requirements is growing. He also pointed out that recent studies on service entrance requirements for electric space heating show that 100 rather than 200 amperes may be practical for most purposes.

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In reviewing changes that are being considered for the 1959 Code,

Mr. Watson predicted that 100 amp service entrance will probably be required for most residential installations. There has been insistence for two appliance receptable branch circuits instead of the one now required, and this seems likely to be included in the new Code. In office buildings, the lighting load is likely to be increased from 3 to 5 watts per square foot with no diversity factor. It is proposed that insulation over 2,000 volts should be ozone resistant.

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New types of wire will probably be recognized. Under consideration is a new silicone type of wire (SA) for 90 C dry location use. A new THW thermoplastic wire for 75 C use seems likely to be included.

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Mr. Watson concluded his talk by predicting the industry's future. He felt that sales expansion will be concentrated largely in the product lines of wire and cable that are already in existence. Secondly, the greatest anticipated increase for wire and cable in the residential field will be to service electric heating installations.

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E. A. Buxton, Manager of Tubular Sales, **Bethlehem Steel Corporation,** discussed the benefits of inter-industry cooperation between NEMA and the American Iron and Steel Institute. As evidence of such cooperation, he pointed to publication of Steel Electrical Raceways, a design manual on raceways, which was developed by the NEMA Rigid Steel Conduit and Electrical Metallic Tubing Section and the AISI Steel Electrical Raceways Committee.

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George Roscoe, Public Relations Director, **National Electrical Contractors Association,** talked about efforts being made by his association to obtain federal legislation which is designed to (1) declare bid shopping and bid peddling to be unfair trade practice, (2) require a prime contractor on government construction to name his mechanical special sub-contractors and the amount of their bids, and (3) provide for re-capture of the fruits of any changes in these amounts by the government.

High Temperature Wire Trends

H. I. Stanback, Chief Engineer, **Square D Company,** in discussing "problems from trend to high temperature wires," listed them in three categories—"heat, cost and voltage drop." High temperature wire, he said, will be extremely helpful when the circuits must run through a hot location such as a boiler room or in proximity to furnaces. It will also permit safe electrical connection to heating elements or perhaps motors which have high temperature insulation.

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While high temperature insulation will aid panelboard manufacturers in many ways, the possible selection of wires two or three sizes smaller than those previously used would require design changes in panelboard equipment. Such extensive changes would cause increases in cost. If the wire runs are of any appreciable length, the heat losses in the smaller high temperature wires will add considerably to their long term cost.

★ ★ ★

Merwin Brandon, Vice President, **Underwriters' Laboratories, Inc.,** cautioned his listeners against proposing unnecessarily stringent additions to the National Electrical Code. Most of the country's electrical safety legislation is based on the code and code provisions are accepted as minimum safety requirements. He also told his audience that electrical inspectors and contractors are becoming confused by the large number of wire types recognized in the Code and suggested that consideration be given to reducing the number. In commenting on high temperature wires, Mr. Brandon said that UL will have to review this type of wire, and also will check panelboard in which it is used. He questioned the advisability of using high temperature wire for general purpose wiring.

C. W. Higbee, Assistant General Manager, Electrical Conductor Division, **Kaiser Aluminum and Chemical Corporation,** in presenting a paper prepared by **H. H. Weber,** Marketing Manager, **Kaiser Aluminum and Chemical Sales, Inc.,** also referred to the many types of insulated wire recognized in the National Electrical Code. There are, it was said, 11 type letters for rubber or rubberlike insulated building wires, 3 type letters indicating 3 different wires for dry locations at 60 degrees centigrade, 4 type letters for wire used at 60 degrees centigrade in combination dry and wet locations, and many others for additional applications. New type letters are being considered, although Mr. Weber contended that these letter types are unnecessary. Instead of letters, he said, the Code should provide recommendations on wire based on its use for wet, dry and combination wet and dry locations. The manufacturer also contended that the complete wiring systems should be reviewed by the industry in order to raise efficiency standards, bring about incorporation of latest developments in all purpose building wires, and deal constructively with the problem of too many type letters.

★ ★ ★

The committee members responsible for organizing the convention program were:

Vernon W. Heimberger, Chairman
M. A. Wachstein, Hatfield Wire & Cable
Richard Steiner, General Cable
Clarence Blumoer, Phelps Dodge
C. W. Higbee, Kaiser Aluminum

★ ★ ★

The program consisted of approximately 15 sessions, all of which were well-attended and the committee deserves to be complimented on its fine work.

★ ★ ★

B. F. Ilsley, General Manager, Wire and Cable Dept., **General Electric Company,** Bridgeport, Conn., is Chairman of NEMA's Wire and Cable Section.

Government Wire Production Information

GSA Manual on Shipping

Publication of a new manual designed to help Federal agencies eliminate waste and costly errors in shipping practices has been announced by **Franklin Floete,** Administrator of General Services.

* * *

The GSA handbook, "Common Shipping Faults and Their Remedies," describes freight shipping problems throughout the Federal Government and suggests ways to solve them. The handbook is designed to assist traffic personnel to perform their duties more efficiently and economically. By calling attention to mistakes most frequently made many costly errors can be eliminated, efficiency increased, and savings made.

* * *

The shipping faults pointed out and remedies suggested are based upon the operating experience of the Transportation and Public Utilities Service since publication of a shipping handbook in 1952. Increased accuracy benefits not only the Government, but also carriers and private industry in these ways: confusion is eliminated; faster deliveries are made; transportation and processing costs are reduced; manpower is conserved; correspondence and claims actions are minimized and public relations are improved.

* * *

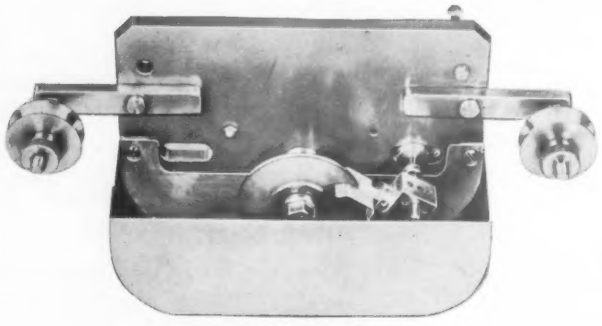
The General Services Administration is distributing a limited number of copies direct to all Federal agencies. The guide is available to the public from the Government Printing Office, Superintendent of Documents, Washington 25, D. C. at an estimated cost of 35 cents a copy.

Announces New Cleaning Compound

Oakite Composition No. 190, the new reverse current cleaner, has been announced by **Oakite Products, Inc.,** manufacturers of cleaning and metal treating compounds.

* * *

Providing greater conductivity and surface activity than previously available in a single electrocleaning material, Composition No. 190 is effective in cleaning heavily smutted steel. It also removes fingerprints, light surface rust, and oxides resulting from welding. Concentrations from 8 to 16 ounces per gallon of water, at temperatures ranging from 180° to 200°F., with reverse current, from 40 to 100 amps. per square foot are used. It rinses well in hot or cold water.



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INSULATED WIRE

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HEAVY DUTY and EXTRA LARGE PRINTERS
GILLIES CONCAVE and
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Here's the first step! Plan now to set up a handy file on Apco Mossberg Steel Reels, Spools and Bobbins. That way you'll always have a ready reference to one dependable source of supply . . . save yourself hours of time and trouble when looking later on.

Next, make it a point to get all the facts you need to specify the right reels, spools or bobbins to meet your individual requirements. Given the opportunity, Apco Mossberg Engineers can custom design units to meet your exact specifications in size, shape, balance and trueness . . . many times at a substantial saving over the units you are now using.

So act now! Send us your specifications or call collect for preliminary recommendations at no obligation.

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Ferry Building
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Canadian Representative:
Hugh P. Williams & Co.
47 Colburne Street, West
Toronto, Ontario, Canada

APCO MOSSBERG COMPANY
Lamb Street, Attleboro, Mass.

Further information is available from Oakite Products, Inc., 21 Rector Street, New York 6, N. Y.

New High Speed Wire Sparker

A new model of high voltage DC sparker which permits non-destructive fault detection at wire speeds of 4000 fpm with an electrode of zero-length, is now available. This sparker, type CVX, provides an entirely new concept in wire sparking. Because higher wire speeds are possible, wire making efficiency is increased and better quality control can be maintained. Non-destructive testing sharply reduces wire rejections, eliminates the repetitive testing of conventional AC test sets, and improves quality control.

★ ★ ★

Zero length electrodes save floor space in a wire line usually necessary for a 36″ long electrode. Conventional AC sparkers supplied with extruders have some destructive power, particularly for small plastic covered hook-up wire, nor do they have the sensitivity and speed of response, even at low speeds, necessary to detect and register all faults. Long electrode types may miss 60% of the faults, tests have shown.

★ ★ ★

For full details, write Peschel Electronics, Inc., R.F.D. #1, Patterson, N. Y.

Titan Dedicates New Brass Rod Mill

Titan Metal Manufacturing Company, nationally known manufacturer of brass and bronze products for industry, formally dedicated their $3,000,000 plant at Newark, Northern California's first brass rod mill. Speaking at the dedication ceremonies president **W. W. Sieg** said "opportunities for industry in the fast growing San Francisco Bay area are among the finest in the nation.

★ ★ ★

James M. Golden, western division manager said, "For more than two years, all of us in Titan Metal Manufacturing Company

have been pointing toward this day. It marks a milestone in our company's long history. We hope it marks a milestone for you, in your busy, friendly, growing community."

★ ★ ★

The company's main plant and general offices are in Bellefonte, Pa.

New Shipping Container

A new collapsible, re-usable steel "transporter" box, designed to fold into 1/5 its original size after unloading, has been developed by the Berger Division of Republic Steel.

★ ★ ★

The unit is intended for one-way shipment of materials, and is said to be specially suited for foreign cargo shipments. The box is loaded and shipped fully erected in sizes ranging from approximately 48x48x48 to 60x60x60 inches, and returned to the sender empty and knocked-down for re-shipment again.

★ ★ ★

The new box design is particularly useful in transporting freight that requires protection from rough handling and pilferage. For security in transit the boxes can be supplied with heavy-duty locking arrangements.

★ ★ ★

Further information may be obtained by writing **Republic Steel Corporation,** Berger Division, 1038 Belden Avenue, N.E., Canton 5, Ohio.

To Distribute Industrial Crepe Papers to Wire and Cable Industry

Dennison Manufacturing Co., Framingham, Mass., announces that **Peters Manufacturing Co.,** Wollaston, Mass., has been granted exclusive rights for processing, application, and sale of Dennison Industrial Crepe Papers to the wire and cable industry.

★ ★ ★

The Peters Manufacturing Co. has specialized for many years in the development of electrical cable

For Moisture Resistance, Specify

TEXTILENE

TWI-FLEX and TWI-WAX

Treated to reduce wicking and prevent leaching, lightly waxed Textilene Twi-Flex and heavily waxed Textilene Twi-Wax provide effective resistance to moisture. Both fillers are extensively employed for non-metallic sheathed cable (building wire), maritime shipboard cable, varnished cambric cable, and underground service entrance cable.

Twitchell's superior Textilene line also includes: Soft, dry fillers — *Twi-Port* and *Glascor** (Fiberglas-centered for high tensile strength without added bulk). Used for control, power, appliance, coaxial and communications cables, and all portable and flexible cords. Fungus-resistant filler — *Twi-Tar.* Used for buried communications cable, expanded ACSR cable, and in other applications.

*Patent Applied For

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Assured supply from a reliable domestic source . . . always available in economical and convenient packaging.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation—also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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PAPER PRODUCTS FOR THE WIRE INDUSTRY

Twisted • Folded • Pressed • Crushed • Shaped • Braided • Woven

TOTELINE
FIBER GLASS SPOOLS
never need maintenance
You'll never find light-weight molded fiberglass Toteline spools in your repair shops because they never need maintenance. They don't splinter, crack, dent or bend out of shape.
LOWEST NET COST
Toteline spools last a lifetime—making the cost per spool-year only a few pennies. They are lightweight, too—reducing handling expenses.
PRECISE WINDS EVERY TIME
The smooth, splinter-free surface of Toteline bobbins eliminates tangles or breaks. Wire coating remains undamaged and stays color-fast.
It will pay you to investigate using Toteline fiberglass reels in your operation. The savings in dollars and efficiency will surprise you. Why not write for more information now.
TOTELINE
MOLDED FIBER GLASS TRAY CO., Linesville, Pa.
World's largest producers of reinforced plastic trays and toteboxes

products, and the production and sale of coated and uncoated tapes. This concern has a well-developed knowledge of the technical problems of cable construction, and is familiar with the needs and technicalities of the industry.

Announces New Inconel Rivets

John Hassall, Inc., Westbury, N. Y., announces the availability of tubular and solid Inconel rivets for service under high-temperature conditions. A typical example of their use is in the assembly of jet-engine combustion chambers.

★ ★ ★

Features of the Inconel rivet (nickel-chrome alloy) are: ability to retain strength and resist oxidation up to 1800F; a head which is free of cracks; uniform quality of metal; and rigid adherence to exacting dimensional requirements. Hassall manufacturing facilities and quality control have met Air Force standards.

★ ★ ★

In addition to these rivets, Hassall produces a wide variety of other rivet shapes and sizes in Inconel, as well as in Monel, stainless and many other corrosion and heat resistant metals.

★ ★ ★

For additional information, write to John Hassall, Inc., Westbury, L. I., N. Y.

Du Pont Opens New Laboratory

On May 21, 1958, **E. I. du Pont de Nemours and Company** announced to the press the opening of a new 5 million dollar laboratory to provide service to customers and to evaluate new and improved products of the company's Electrochemicals and Pigments Departments.

★ ★ ★

For both departments, the laboratory provides a research center for the solution of the problems of customers, for the development of new products and uses, and for the training of field representatives.

★ ★ ★

The laboratory contains 81,000

square feet of floor space, in which are 150 rooms, laboratories and demonstration areas, staffed by 130 chemists, metallurgists, and other specialists.

★ ★ ★

The press was taken on a tour of the facilities and shown some of the new developments in pigments for paint, plastics and paper, an outstanding new product being the new colorfast "Monastral" pigments that have remarkable non-fading characteristics, especially in the scale of red colors.

★ ★ ★

Also shown in the Electrochemicals section were new metal cleaning techniques, a new copper plating process for wire developed jointly by du Pont and **National-Standard Company**, and a new level plating process for applying copper to steel parts for subsequent tinning and chrome plating operations.

★ ★ ★

The wire plating process is unusual in that copper may be applied to a wide variety of steel wires, from low to high carbon, in any desired thickness and of an exceptional uniformity as to thickness of coating.

★ ★ ★

Other features demonstrated during the tour were the company's sodium hydride process for descaling steels and the work being done in the production and processing of titanium sponge, much of which finds its way in wire and wire products.

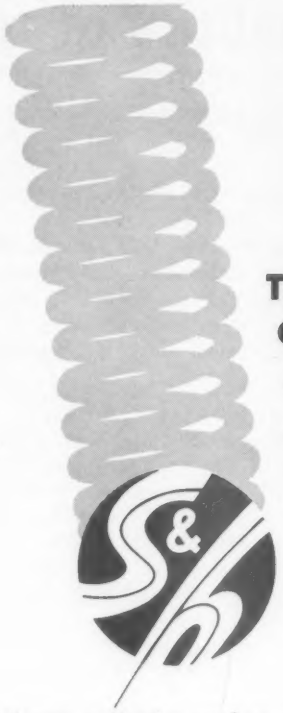
★ ★ ★

The new laboratories, which are an addition to a group of other similar structures serving other departments, should go far toward developing an individualized service to du Pont's customers in the pigments and electrochemicals branches of its work.

Get the habit of reading regularly

WIRE AND WIRE PRODUCTS

The Wire Man's Magazine



THE MOST COMPLETE LINE OF SPRING MAKING MACHINERY . . .

DESIGNED AND BUILT FOR THE METAL WORKING INDUSTRY

Sleeper & Hartley produce a complete line of spring-making machinery serving the basic metal working industries:

- Fabricated Metal Products
- Instruments
- Ordnance
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- Electrical Machinery
- Machinery (except electrical)
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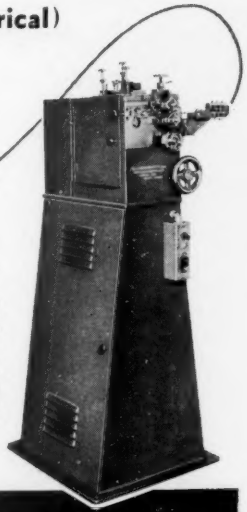
Quality and dependable service during 47 years of Sleeper & Hartley production have given the customer satisfaction for which we constantly strive.



No. 0 UNIVERSAL SPRING COILER, ESCAPEMENT TYPE. Series 720 — 73" Model.

This newest, versatile machine in the exclusive S&H escapement line incorporates the most advanced design engineering in the field, to give greater wire feed range and high speed production. Its many features include extremely accurate wire feed and controls for fine precision adjustment. Inertia is minimized since the only thing that starts and stops with this type feed mechanism is the wire itself.

Write for latest information . . .

SLEEPER & HARTLEY, INC., BOX 1249, WORCESTER 1, MASS., U.S.A.

Outstanding Personalities of the Wire Industry

Furnace Firm Elects New President

Henry M. Heyn, formerly Vice President and General Manager of The Industrial Division of the **Surface Combustion Corp.,** Toledo, Ohio, was recently elected President, to replace **Frank H. Adams,** deceased.

Union Wire Rope Promotions

Union Wire Rope Company, Kansas City, has announced the following changes in the status of its officers: **M. G. Ensinger,** formerly President, has been elected Chairman of the Board; **J. H. Hatch,** who was Vice President and Production Manager, was made President and General Manager; **Maurice B. Hansell, Jr.** has been elevated to Vice President and Production Manager; and **George P. Lacy** was elected Vice President and General Sales Manager, wire and wire rope products, succeeding **L. B. Schraub,** now a consultant to the firm.

A-C Appointments

Appointment of **William D. Dineen** as supervisor, distributor sales, electrical department, Allis-Chalmers Norwood Works, has been announced by the company.

* * *

Mr. Dineen, who had been supervisor of sales promotion in the electrical department at Norwood Works, will handle the sales and promotion of all of Norwood Works' electrical department products through distributors. He has been associated with Allis-Chalmers since 1940.

* * *

Mario A. Schnetzler has been assigned to the engineering analysis section of the Industries Group. He holds a master's degree in electrical engineering from the Swiss Federal Institute of Technology, Zurich, where he served as assistant professor from 1955 to 1957. He recently completed Allis-Chalmers training course for graduate engineers.

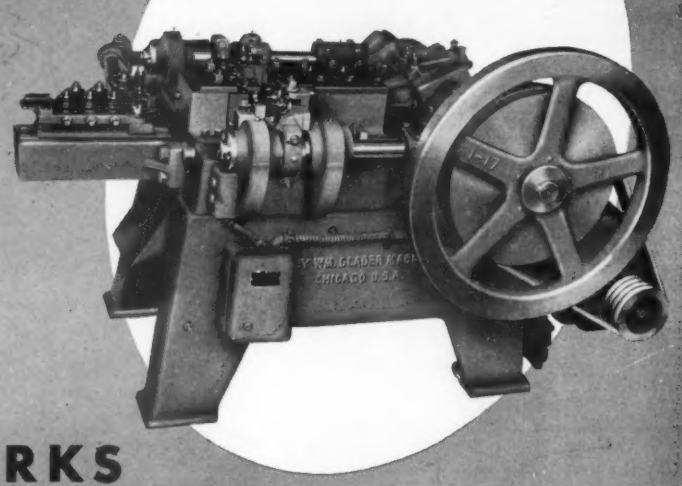
Crucible Steel Appointments

Dwight W. Kauffman has been appointed Manager of **Crucible Steel Company of America's** Titanium and Vacuum Metal Product Division at Midland, Pa.

* * *

William G. Slack is now Superintendent of the bar finish and inspection department at the Sanderson-Holcomb Works in Syracuse, N. Y.; at the same plant **Joseph G. Eckert** has been appointed Superintendent of the conditioning and billet yard; and at the Park Works, Pittsburgh, Pa., **Richard E. Parrish** has be-

high efficiency — low cost
with GLADER wire nail machines



Eliminate costly down-time in the Nail Mill by replacing obsolete machines with new GLADER NAIL MACHINES . . . For tops in efficiency and economical operation use GLADERS.

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MACHINE WORKS

210 N. RACINE AVENUE • CHICAGO 7, ILLINOIS

Export Dept., 122 East 42nd Street, New York 17, N. Y.

come Superintendent of Engineering and Maintenance, replacing **A. G. Nicola,** who has been transferred to Syracuse.

Lee Wilson Appointment

J. H. Werner was appointed Assistant Sales Manager of the **Lee Wilson Engineering Company,** Cleveland, Ohio, it was announced by **J. L. Whitten,** Vice President and General Manager.

★ ★ ★

Mr. Werner, a graduate of the Missouri School of Mines and Metallurgy, joined the Lee Wilson Engineering Company in October, 1941, starting as Service Engineer and serving various capacities as Production Manager, Sales Engineer and, most recently, District Manager-Chicago.

Reynolds Appoints Sales Executive

M. Neal Burleson has been named to a newly-created position, manager of aluminum can market sales, by **Reynolds Metals Company.**

★ ★ ★

Mr. Burleson came to Reynolds from Continental Can Company, where he was a packaging engineer. Previously he was a development engineer with Mead Corporation and also was associated with B. F. Goodrich Company. He is a graduate of the University of Texas.

NOPCO Promotes Two Men

Harold A. Swanson, Vice President of **Nopco Chemical Company,** has announced the appointments of Charles Lighthipe to the post of Technical Director of the company's Industrial Laboratories and **Dr. Ramsey Christian** to the position of Director of the Industrial Development Laboratories.

★ ★ ★

Departments under the management of the Industrial Laboratories are Paper, Tanning, Detergents, Textiles, Metal Working, Insecticides, and Protective Coatings.

Made Assistant General Manager

Raymond J. Mucci has been appointed assistant to the general manager of the **Naugatuck Chemical** division, **United States Rubber Co.,** it was announced by **Earle S. Ebers,** vice president and general manager.

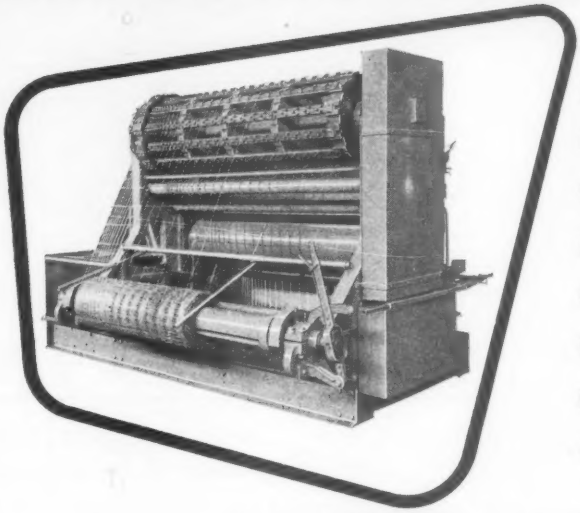
★ ★ ★

Mr. Mucci, formerly a member of the chemical division's commercial development department, will be engaged in general forecasting and business research assignments.

★ ★ ★

He joined Naugatuck Chemical as a research chemist in its research and development department in 1952. He is a graduate chemical engineer, University of Connecticut, and has a master's degree in business administration from the Columbia University

Interlocking FENCE LOOMS



- Fastest — Most Efficient
- Preferred by Leading Mills
- Low Maintenance Cost
- Wrapped Stay Fence
- Straight Stay Wires
- Integrated — Space Saving
- Replaceable Main Bearings
- Single or Double Strands
- Years of Low Cost Production

Write for Detailed Information — Without Obligation

Interlocking Fence Co., Box 8, Morton, Ill.

Specialists In Fence Looms

Graduate School of Business Administration.

Heat and Control Adds to Staff

Rolland R. La Pelle, formerly Manager of **Westinghouse Industrial Furnace** sales on the West Coast, has joined the staff of **Heat and Control, Inc.,** San Francisco, Calif., as Manager of sales and engineering on aircraft, missile and special research furnace projects. **Westinghouse** discontinued its industrial furnace division in March 1958.

★ ★ ★

Mr. La Pelle's talents will be made available to supplement Heat and Control's sales and engineering representation in all territories, with headquarters in the main office at 1615 Cortland Avenue, San Francisco 10.

Crucible Steel Advances Officers

Crucible Steel Company of America has announced the election of **L. L. Ferrall** as Executive Vice President and **J. D. Dickerson** as Vice President-Operations.

★ ★ ★

Mr. Ferrall was formerly Vice President-Operations and Mr. Dickerson was Manager of Steel Production. The post of Executive Vice President has been vacant in recent years.

Morse Chain Elects New President

Robert O. Bass was recently elected president and general manager of **Morse Chain Co.,** Ithaca, N. Y., subsidiary of Borg-Warner Corp. He had been executive vice president and assistant general manager Mr. Bass succeeds **Stanley J. Roush,** who will now devote his time to his new responsibilities as group vice president in Borg-Warner's Chicago headquarters.

E.F. Appoints Manager of Export Sales

Robert C. Hiltbrand has been appointed Manager of Export Sales by **The Electric Furnace Company,** Salem, Ohio. Joining the organization in 1938, he has served in their Mechanical Engineering, Field Erection, Electrical, and Fuel Divisions and in other Departments.

G.E. Promotes Morrison

Grant A. Morrison, formerly engineering administrator, has been named manager of product design and application engineering at the **Metallurgical Products Department** of **General Electric Company,** Detroit.

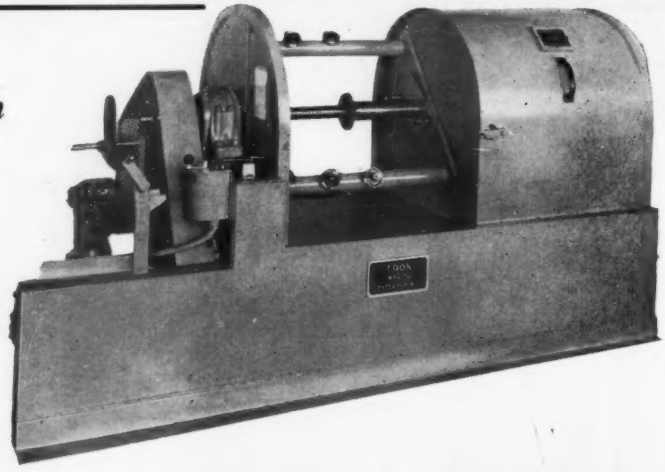
★ ★ ★

He will be responsible for design and application of carbide products — including dies, components, mining and cutting tools — the machineability laboratory and drafting service.

★ ★ ★

A graduate of Lawrence Institute of Technology, he joined General Electric in 1951 and was in tool sales work in Wichita, Kansas, Tulsa and Houston.

Your answer for producing bunched wire with the smooth concentric qualities of stranded wire . . .



COOK
BUNCHER-STRANDER
makes every foot of wire perfectly uniform

For concentric wires with layers made up of wires in opposite lay directions, or for semi-concentric wire with layers in same direction but with different lays . . . a Cook Buncher-Strander delivers uniform wire at high speed. The secret is the single twist flyer and the Cook patented method of providing differential speeds between flyer and reel. Why delay? Get the complete details today by writing for illustrated brochure.

A MODEL FOR EVERY PRODUCTION NEED

MODELS AVAILABLE	BH-8	BH-12	BH-16	BH-22	BH-24
CAPACITY	45 lbs.	90 lbs.	200 lbs.	500 lbs.	1000 lbs.

COOK **MANUFACTURING COMPANY**
50 EAST 25th ST., PATERSON, N. J. • ARmory 4-6380

Tensolite Expands Field Force

As part of a program to provide increased customer service and assistance, two sales engineers each with over six years in the miniature high temperature wire and cable field have been re-assigned by **Tensolite Insulated Wire Co. Inc.,** Tarrytown, N. Y.

★ ★ ★

Donald Dombrowsky, who formerly was with the R&D section of GPL and has been with Tensolite for two years, takes over a territory including Delaware, Maryland, D. C., and Northern Virginia. **Frank J. Wrobleski,** who was with Kings Electronics before joining Tensolite in 1955, will cover upper New York State.

Made Factory Manager

The Gibson Division of **Associated Spring Corporation,** Chicago, has appointed **Leonard M. Kulze** from Chief Engineer to Factory Manager. **Joseph A. Harinek** has been made Chief Engineer to take the post vacated by Mr. Kulze.

To Handle Equipment Sales For H-VW-M

M. A. Tardiff, formerly general equipment sales engineer for the J. C. Miller Division in Grand Rapids, Mich., has been appointed Manager, General Equipment Sales by the **Hansen-Van Winkle-Manning Co.,** Matawan, N. J., makers of metal processing equipment.

Becomes Officer of RBW

Russell, Burdsall and Ward Bolt & Nut Company, Port Chester, N. Y., has announced the election of **W. Gould Jones** to the post of Vice-President—Sales. He succeeds **Harry O. McCully,** who has been elected Senior Vice President. Mr. McCully will continue to be active in the formulation of sales policies.

To Direct Electrical Sales

The appointment of **Edward Simmons** as Director of Sales, Electrical Division of **Triangle Conduit & Cable Company, Inc.,** New Brunswick, N. J. was announced by **Carl S. Menger,** Executive Vice President. In this post he will be responsible for the sale of Triangle electrical products, including Power, Control and Lighting Cables, Building Wire and Conduit.

★ ★ ★

He joined Triangle in 1937, became Assistant Manager of the Special Cable Division in 1941, and Manager in 1942. He was made Assistant to the Director of Sales in 1947. Prior to his present appointment, he held the post of Executive Assistant to the Vice President in Charge of Sales.

Get the habit of reading regularly
WIRE AND WIRE PRODUCTS
The Wire Man's Magazine

HEAVY DUTY
BREAK-DOWN REELS

1000#
2000#
4000#
} capacities

Rugged Design including patented DURA-CURL rim, and many other features necessary to provide the *Strength* and *Durability* needed for continued successful performance.

Also complete line of sizes of Modern High Speed Wire Drawing NO-CREV Spools and Reels for both fine and intermediate size wire.

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#102

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50c for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,833,145, APPARATUS FOR DETERMINING TENSION IN WEB AND STRAND MATERIAL, patented May 6, 1958 by Robert W. McCullough, Clemson, S. C.

A tensiometer is disclosed for determining the tension in a moving sheet of web or strand material including a pair of closely spaced parallel rolls of head and foot roll supports, a force measuring member, an indicator support associated with the roll support and an abutment carried by the roll support so that upon the tension in the sheet of web or strand material causing a torsional stress to be placed upon the rolls tending to rotate the rolls and the roll support relative to the indicator support, the abutment will engage and transmit force to the force measuring member to, in turn, effect a variation in the position of the indicator to indicate the tension in the sheet of web or strand material. There are 20 claims.

★ ★ ★

No. 2,833,325, COUNTERSUNK FLEXIBLE HEAD THREADED FASTENER, patented May 6, 1958 by Rudyard E. Laisy, Rocky River, Ohio, assignor to The National Screw & Manufacturing Company, Cleveland, Ohio, a corporation of Ohio.

The flat face of the screw head at the shank end is provided with a number of segmental projections adapted to bite into the work. One use of the screw is in making a good electrical connection when the work is coated with ceramic material or the like.

★ ★ ★

No. 2,833,329, WIRE PACKAGING TAKEUP AND COILING APPARATUS WITH ROTATABLE FLYER, patented May 6, 1958 by James W. De Poy, Oakland, Calif., assignor to The Colorado Fuel and Iron Corporation, Denver, Colo., a corporation of Colorado.

In addition to the flyer there is a device on the flyer for changing the direction of movement of a wire to be handled thereby to the plane of rotation of the flyer, a device on the flyer alone for then wholly imparting a desired circular cast to the wire in this plane of rotation and a device, also on the flyer for changing the helical cast characteristic of the circular cast wire, this circular cast imparting device and the helical cast changing device alone determining the final cast of the wire in a coil thereof formed by the apparatus.

★ ★ ★

No. 2,834,828, ELECTRIC CABLE, patented May 13, 1958 by Lawrence C. Ebel, Hastings-on-Hudson, N. Y., assignor to Anaconda Wire and Cable Company, a corporation of Delaware.

About the wire conductor and a layer of insulation thereabout, having a high coefficient of thermal expansion is a shield tape comprising a layer of thin metal securely bonded to a layer of elastic material, the thin metal being formed with repeating groups of laterally extending expansion slits longitudinally spaced along the length of the metal tape, each group of the expansion slits comprising at least two laterally overlapping longitudinally spaced slits which individually extend laterally only part way across the metal and which together extend laterally from edge to edge completely across the shield.

★ ★ ★

No. 2,834,940, APPARATUS FOR TESTING WIRE COATINGS, patented May 13, 1958 by Richard D. Dermer and John A. Whitney, Fort Wayne, Ind., assignors by mesne assignments, to Essex Wire Corporation.

This apparatus is for applying a potential difference across a dielectric for testing purposes.

Far greater production in less space with lower cost equipment . . . for all steel and non-ferrous wire.
The fastest, most uniform way to heat treat wire* is often far lowest in cost!
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* Write for case history bulletins on Ajax Electric Salt Baths for
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ASSOCIATED COMPANIES:
AJAX ELECTRIC FURNACE CORP. • AJAX ELECTROTHERMIC CORP. • AJAX ENGINEERING CORP.

No. 2,835,153, WIRE ROLLING APPARATUS, patented May 20, 1958 by William G. Langton, Lincoln, Mass., assignor, by mesne assignments, to the United States of America as represented by the Secretary of the Navy.

The apparatus is said to roll wire into a thin strip. Special means is provided whereby variation in the angle at which driving forces from a drive motor are applied to a first of two riders are avoided.

★ ★ ★

No. 2,835,280, APPARATUS FOR ASSEMBLING SPRING UPHOLSTERY UNITS, patented May 20, 1958 by Richard Eustace Probyn Miers, London, England, assignor to Pullman (Patent) Products Limited, London, England.

More specifically a clinching machine is disclosed for use in the production of mattress and cushion spring assemblies of the type comprising a plurality of rows of helical or hour-glass coil springs connected together by tie wires each having equidistantly spaced hook-like projections inter-looped with the end convolutions of the springs and in which each tie wire is common to either the lower or the upper end convolutions of two closely related parallel lines of springs and also in which the hook-like projections are loosely interlooped with the spring ends.

★ ★ ★

No. 2,835,281, PRODUCTION OF SPRING INTERIORS FOR MATTRESSES AND THE LIKE, patented May 20, 1958 by Richard Eustace Probyn Miers, London, England, assignor to Pullman (Patent) Products Limited, London, England, a British company.

A method of producing spring assemblies so as to produce a complete assembly in which parallel lines of springs are obtained with the end convolutions of the springs coupled together by tie wires parallel and alternating with the lines of springs and interlaced with the springs by pre-formed S-shaped hook-like parts of the tie wires inter-engaged with the end convolutions is disclosed. There are 15 claims.

★ ★ ★

No. 2,835,282, RECIPROCATING WIRE-BENDING DEVICE FOR FORMING COMPLEX BENDS, patented May 20, 1958 by Karl A. Schmuldt, Emmaus, Pa., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

A device for forming bends in wire leads extending from and secured to a holder, is disclosed.

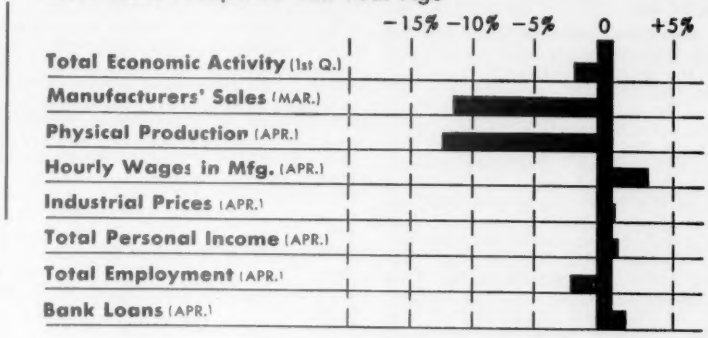
★ ★ ★

No. 2,835,283, WIRE TWISTING MACHINE, patented May 20, 1958 by Karl Thone, New York, Gerard Olsen, Mineola, John Karkheck, Rosedale, and Karl Samsonsen, Brooklyn, N. Y., assignors to Sperry Rand Corporation, Ford Instrument Company Division, Long Island City, N. Y., a corporation of Delaware.

A wire twisting machine adapted for twisting a number of individual strands of wire into a single cable of predetermined length is set out in this patent.

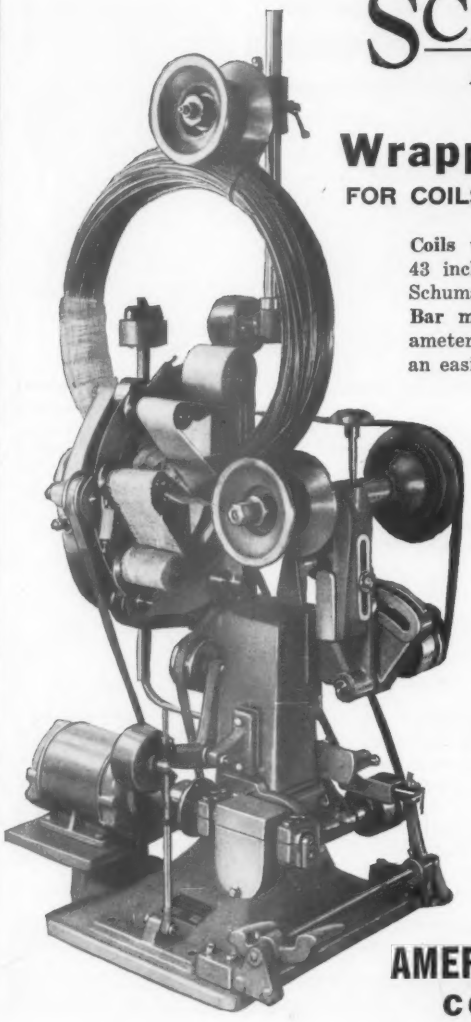
UP OR DOWN — AT A GLANCE

Latest Data Compared with Year Ago



SCHUMAG
AACHEN

Wrapping Machine
FOR COILS, BARS AND BUNDLES



Coils with outside diameters up to 43 inches are handled by the basic Schumag WS 2a machine illustrated. Bar material up to 6 inches in diameter is handled by the addition of an easily attached auxiliary device.

Outstanding Features

- Coils, bars and bundles automatically wrapped tightly and smoothly.
- Solidly guided open wrapping ring.
- Precision adjustment of wrapping-band tension. Once set, tension remains constant.
- Adjustable wrapping pitch. Special ranges available on order.
- Automatic shut-off of wrapping mechanism, adjustable for any size of coil.

Write for descriptive literature, or send us your wrapping specifications

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AMERICAN LAUBSCHER CORPORATION

Fisk Bldg., 250 West 57th Street
New York 19, N. Y.

No. 2,835,312, WIRE SPRING STRUCTURE, patented May 20, 1958 by William H. Neely, Cleveland, Ohio, assignor to The Universal Wire Spring Company, Bedford, Ohio, a corporation of Ohio.

The structure includes a sinuously corrugated wire spring bent to form a wire spring with a resting portion and accordion fold-shaped support, with an elongated straight wire member coupling the resting portion of the wire spring with the support, the elongated straight wire member including an end portion extended through the resting portion of the wire spring between two adjacent cross members thereof and having a lateral extension on the end portion hooked over one of the two adjacent wire cross members to effect in a loaded condition of the spring contact of the end portion of the elongated straight wire member with the other one of the two adjacent wire cross members for cantilever-like coupling of the straight wire member with the resting portion.

No. 2,835,314, WIRE SPRING STRUCTURE, patented May 20, 1958 by William H. Neely, Cleveland, Ohio, assignor to The Universal Wire Spring Company, Bedford, Ohio, a corporation of Ohio.

This structure embodies two laterally spaced zigzag wire springs with resting portions and supporting arms, and a single V-shaped wire element secured at longitudinally spaced areas to the bottom face of the resting portion of each of the springs to non-shiftably connect the two wire springs to each other and reinforce a longitudinally extended portion of the resting portion of each of the springs, the V-shaped wire element including two elongated supporting arms extended in symmetrical, laterally spaced relation to the wire springs toward supporting arms thereof.

★ ★ ★

No. 2,835,315, WIRE SPRING STRUCTURE, patented May 20, 1958 by William H. Neely, Cleveland, Ohio, assignor to The Universal Wire Spring Company, Bedford, Ohio, a corporation of Ohio.

This is a seat-back spring structure much like the spring of patent 2,835,-312.

★ ★ ★

No. 2,835,316, WIRE SPRING STRUCTURE, patented May 20, 1958 by William H. Neely, Cleveland, Ohio, assignor to The Universal Wire Spring Company, Bedford, Ohio, a corporation of Ohio.

The structure of this patent is related to that of patent 2,835,314.

★ ★ ★

No. 2,836,203, MACHINE FOR INSERTING AND COILING THE WIRE IN BINDER RING FORMATION, patented May 27, 1958 by Arthur F. Brook, Poughkeepsie, N. Y., assignor to Mechan-O-Corporation, Poughkeepsie, N. Y., a corporation of New York.

With two stacks of perforated sheets supported in angularly related position with the perforations of one stack adjacent the other, the machine feed binding wire having straight parallel side portions connected by transverse back portions through the perforations after the straight portion is curled by curling dies.

★ ★ ★

No. 2,836,204, COIL WINDING MACHINE, patented May 27, 1958 by Lowell M. Mason, Fort Wayne, Ind., assignor to General Electric Company, a corporation of New York.

For winding electric motor coils the inventor provides a pair of electric motors operating in opposite directions with a wire carrier rotated by motors alternately about a form to thereby form coils thereon, a clutch adapted selectively to connect the wire carrier to one of the motors thereby to vary the direction of rotation of the wire carrier and counter means for determining the number of rotations of the wire carrier means during a single coil forming operation.

★ ★ ★

No. 2,836,205, COIL SPRING PRODUCING MACHINE, patented May 27, 1958 by William E. Wunderlich, Muncie, Ind., assignor to Wunderlich Spring Machinery Company, a corporation of Illinois.

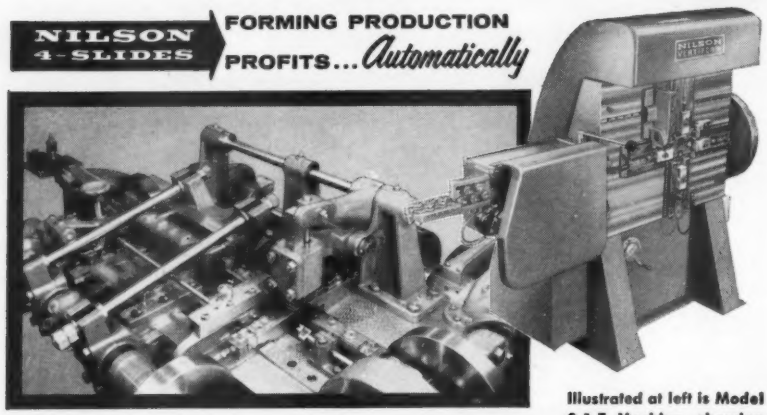
In a machine for producing wire coil springs having a knotting mechanism, the inventor provides a stop finger with a flat engaging surface for engaging the end of the wire for movement for assuring proper knotting.

★ ★ ★

No. 2,836,287, WIRE FEEDING AND POSITIONING APPARATUS, patented May 27, 1958 by Charles P. Cady, Canastota, N. Y., assignor to Westlake Manufacturing Corporation, Canastota, N. Y., a corporation of New York.

There is provided a frame being movable back and forth over an arcuate path between work stations upon oscillation of a shaft, the frame having aligned wire guiding apertures for guiding the wire radially from the support shaft, a gripper support slidably mounted in the frame for movement

NILSON 4-SLIDES FORMING PRODUCTION PROFITS... Automatically



Illustrated at left is Model S-1-F Machine, showing built-in press and open construction of forming area. Directly above is the new Vertiform Machine.

WHY Cost-Conscious Companies CHOOSE A NILSON

Every Nilson 4-Slide Forming Machine is designed with built-in flexibility! Most models handle either wire or ribbon metal with equal speed and accuracy . . . can combine stamping, welding and other secondary operations with the basic forming cycle. Easy access to tooling insures rapid setups, minimum down-time for job changeovers.

Whatever your forming application, there's a Nilson 4-Slide to do the work faster, more economically! With 17 horizontal models and the new "Vertiform" machine, Nilson offers you the widest selection of 4-slide equipment.

Investigate the cost-cutting advantages of Nilson 4-Slides in your operations! For a production evaluation of your parts, send prints or samples today.

SIZE RANGES:
Wire up to ½" diameter
Ribbon stock to 3½" wide.
Feeds up to 32"
5 TO 75 TON
PRESS SECTIONS

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AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

parallel to the axis of the guiding apertures, a wire gripper mounted on the gripper support and having portions movable into and out of engagement with the wire, actuating means operable upon initial movement of the frame toward one of the work stations to move the portions of the gripper out of engagement with the wire and to move the gripper support toward the axis of the shaft and, upon further movement of the frame toward the station, to move the portions of the gripper into engagement with the wire and to move the gripper support radially outwardly from the support shaft a predetermined distance.

★ ★ ★

No. 2,836,370, COIL WINDER, patented May 27, 1958 by Joseph M. Drees, Sunnyvale, and Kenneth L. Jones, Pacific Palisades, Calif., assignors to Sylvania Electric Products, Inc., a corporation of Massachusetts.

There are eight claims to this coil winder for winding wire on a mandrel with a predetermined spacing between turns by utilizing a lathe including a lead screw and a chuck for holding the mandrel.

★ ★ ★

No. 2,836,518, MODIFIED POLYVINYL ACETAL INSULATED CONDUCTORS, patented May 27, 1958 by John A. Loritsch and Edward W. Daszewski, Schenectady, N. Y., assignors to General Electric Company, a corporation of New York.

About the copper wire conductor is an outer insulation comprising essentially a hard, flexible, tough, abrasion-resistant and Freon-resistant coating.

William H. Eisenman

Nationally and internationally known among members of the metallurgical profession and in the metalworking industry, **William Hunt Eisenman,** 73, secretary and a founder-member of the **American Society for Metals,** died Friday, May 30 in a LaJolla, California hospital.

★ ★ ★

Mr. Eisenman, who served the American Society for Metals for 40 years and was managing director of the National Metal Exposition and Congress ("Metal Show"), succumbed following a heart attack at his Palm Springs, California, vacation home.

★ ★ ★

"The entire metalworking world will mourn the loss of a dedicated and talented leader who did much to spur progress in the field," declared ASM President **G. MacDonald Young,** technical director of the **Aluminum Company of Canada,** Montreal.

A native of Jamestown, Ohio, Mr. Eisenman joined the American Society for Steel Treating, forerunner of the ASM, in 1918 as national secretary. Under his leadership the Society grew from a one-desk organization with fewer than 200 members to more than 30,000 members in 105 Chapters in the U. S. and Canada.

★ ★ ★

The late ASM secretary was educated at Kenyon College, Stanford University, Morningside College, Iowa, and Ohio State University. After a brief period as a professional football player with the old Olympic Club, he began his career as a high school principal in Olathe, Kansas, was head of the chemistry department at Racine (Wisc.) College, and superintendent of schools in Elmhurst, Illinois.

★ ★ ★

His thousands of friendships in the metalworking industry were made during his long service as managing director of the National Metal Show, one of the nation's largest industrial expositions. He

INCREASE PRODUCTION . . . . .

REDUCE OPERATING COSTS . . . . .

With the

New Whitacre

WIRE DRAWING and GALVANIZER

DEAD BLOCKS

YOU GET THESE ADVANTAGES:

- **No stopping for stripping.**
- **No tangling nor snarling from handling.**
- **Permits packaging into stationary container or uninterrupted palletizing on stems.**
- **Greatly reduced floor space requirements.**
- **Design simplicity. No back-gearing nor similar mechanisms.**
- **Low capital investment—low maintenance.**

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also directed the Western Metal Exposition and Congress biennially at Los Angeles, for 20 years, and shortly before his death had launched the new Southwestern Metal Exposition and Congress, at Dallas, Texas.

★ ★ ★

His contacts were world-wide and he was originator and secretary general of the first World Metallurgical Congress at Detroit in 1951 and of the second Congress at Chicago in 1957. Both drew metals scientists from 40 countries.

★ ★ ★

Mr. Eisenman was honorary member of Die Deutsche Gesellschaft für Metalkunde (Germany), Societe Francaise de Metallurgie (France), Association des Ingenierures Sortis de l'Ecole de Liege (Belgium), and the Iron and Steel Institute (Great Britain). He was awarded the A.S.M.'s Gold Medal in 1956, for distinguished contribution to metallurgy.

During World War II he served as secretary of a special committee of 20 scientists working under auspices of the National Academy of Sciences on wartime metals problems and metals conservation.

★ ★ ★

He had been secretary of the Metal Treating Institute, president of the National Association of Exhibit Managers and the American Convention Institute. He was on the advisory committee for the Chicago World's Fair (1933) and director of St. Louis, Philadelphia and Kansas City civic celebrations.

William Hunt Eisenman

★ ★ ★

During the past year, Mr. Eisenman donated to the American Society for Metals a 100-acre tract on his Russell Township farm, "Sunnimoor," in Geauga County east of Cleveland, Ohio. Construction is now underway there on the "ASM of Tomorrow," new $2,000,000 headquarters building for the Society. Feature of the building will be a huge geodesic dome, visualized by Mr. Eisenman as symbolic of the world's metallurgical progress.

★ ★ ★

At the time of his death, Mr. Eisenman was scheduled to receive an honorary Doctor of Laws degree from Western Reserve University, Cleveland, Ohio.

★ ★ ★

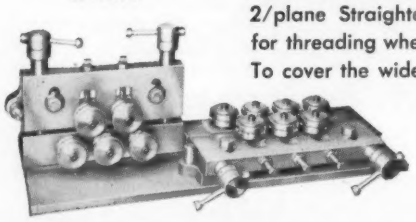
In 1932 **The Wire Association's** Executive Secretary, Richard E.

Sjogren 2 PLANE ROLL STRAIGHTENERS

RIGHT HAND
For Wire Diameter
1/16-1/8"

Sjogren Two Plane Roll Straighteners are fully ball bearing for heavy production duty. They are designed to accommodate all sizes and grades of round or shaped wire whether it be high carbon, low carbon or copper, as well as the many alloys, from .010" to .375". Once set for the job at hand Sjogren 2/plane Straighteners may be opened and closed for threading when making coil changes without effecting the adjustment of the setting. To cover the wide range of wire diameters there are several size groups manufactured with either left or right hand direction. Each is individually produced to exact specifications for the grade, size and type of wire to be processed. Sjogren Two Plane Roll Straighteners do their duty each day, every day in the year.

LEFT HAND
For Wire Diameter
3/16-3/8"



Sjogren TOOL & MACHINE CO., INC.
SINCE S&S 1927

WIRE PULLERS • WEDGE GRIPS • JAWS FOR ALL MAKES OF PULLERS AND TESTING MACHINES • CAGE ROLLERS • SWAGING HAMMERS • POINTING DIES • WIRE SPOOLERS

Used by Wire Men Who Want the Best!

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Brown, negotiated with Mr. Eisenman to make arrangements to hold its Annual Convention simultaneously with that of the American Society for Metals and to participate in the National Metal Congress and Exposition. The first such convention was held in Buffalo that year.

★ ★ ★

This close relationship with the ASM was continued for eleven years, during which time our membership and the Metal Show attendance grew to a point where it was no longer possible to secure quarters for our members in one hotel. The Wire Association accordingly withdrew in 1944 as a participating society and held its first independent convention in Pittsburgh at the William Penn Hotel, substituting plant inspection trips to wire mills for the Metal Show exhibits, a procedure that has been eminently satisfactory from the Association's standpoint.

★ ★ ★

During this long period of affiliation with the ASM, the officers and many members of The Wire Association came to know and respect Mr. Eisenman for his extraordinary ability as an organizer and manager. They extend to the American Society for Metals and Mr. Eisenman's former associates their regret and deep sympathy.

Introduces Safety Lock Wire Dispenser Package

A new package to reduce waste of stainless steel safety lock wire in aircraft, automotive and industrial maintenance has been introduced by **National-Standard Company.**

★ ★ ★

The wire, used to lock nuts and other fasteners subject to vibration, is packaged in one-pound dispenser cans—large enough to provide a mechanic with all the wire he needs for many days' work and small enough to carry conveniently in tool boxes. Wire is coiled uniformly in the dispenser to prevent tangling and is easily pulled through a hole in the top of the package.

★ ★ ★

The lock wire is produced in all standard sizes — .020″ through .041″ diameter — including the .032″ diameter most commonly used in aircraft work and is available from National-Standard Company distributors. Detailed specifications of the dispenser and wire can be obtained by writing National Standard Company, Niles, Mich.

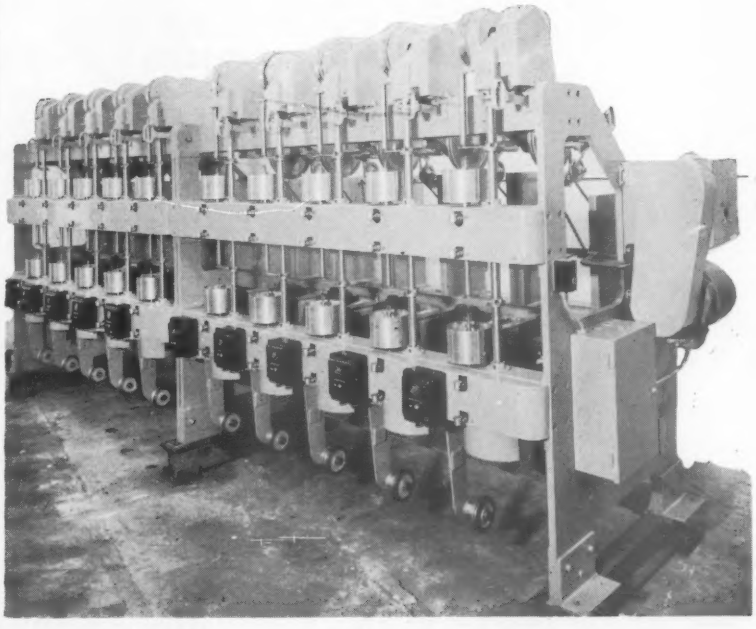
Reynolds Metals Move Sales Offices

The sales headquarters of **Reynolds Metals Company** moved from Louisville, Ky., to Richmond, Va., at the end of May. About 400 sales employees and families — totaling about 1,300 persons — were involved in the mass transfer.

★ ★ ★

Most of the aluminum company's sales operations, which are headed by **David P. Reynolds,** executive

2D-10-MBB INSULATION WINDING MACHINE No. 1129



APPLIES DOUBLE COVER TO 10 LINES OF WIRE SIMULTANEOUSLY. NOMINAL WIRE RANGE #15 TO #25 B&S GAUGE (.057″ TO .018″ or 1.450MM TO .455MM). STANDARD CAPSTANS 8″ DIAMETER. SUPPLY WIRE LETOFFS AND TAKE-UPS ARE AT REAR OF MACHINE NOT SHOWN. MACHINE CAN BE ARRANGED SPECIAL WITH 12″ DIAMETER CAPSTANS FOR HEAVIER WIRES.

EST. 1855 AIMCO INC. 1915

"American" AIM INSULATING MACHINERY COMPANY

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FAIRHILL AND HUNTINGDON STREETS

PHILADELPHIA 33 PENNSYLVANIA U.S.A.

vice president for sales, are now located in the new Reynolds office building in Richmond.

★ ★ ★

"This move," Mr. Reynolds said, "will bring together in Richmond all of our headquarters managerial functions, including manufacturing, marketing, advertising, research and corporate groups." Unaffected by the move are seven Reynolds aluminum fabricating plants in Louisville.

Circular Slide Rule Offered

General Industrial Company has just introduced a handy circular Slide Rule for engineers and plant and office executives. Anyone who must perform simple calculations will find this convenient, pocket-size calculator extremely useful in his work.

★ ★ ★

Operation of the rule is simple and the results are accurate. To multiply, divide and find proportions is easy and exceptionally fast with this convenient circular rule. Complete easy-to-follow instructions will be included with each slide rule.

★ ★ ★

For your free Circular Slide Rule, write to General Industrial Co., 5738 Elston Ave., Chicago 30, Ill.

New Wet Dust Collector

A revised edition of a 12-page bulletin describing and illustrating a wet type dust collector that separates the dust from the air by centrifugal and impingement action against wetted surfaces, without the use of sprays, moving elements, and water eliminators, is now available.

★ ★ ★

Bulletin No. 581 may be obtained by writing to **Dust Suppression & Engineering Co.,** 120 South Broadway, P. O. Box 67, Lake Orion, Mich.

Bulletin on Pancake Motors

The Louis Allis Co., Milwaukee 1, Wis., has published a four page bulletin, No. 2100, on its new enclosed Pancake Motors that reduce motor length up to 60% over standard motors.

★ ★ ★

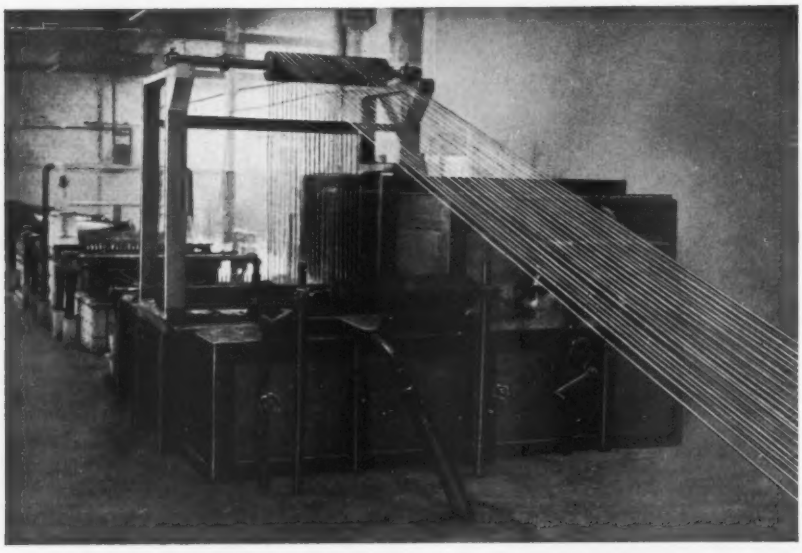
The bulletin presents full engineering information on these flange type motors of radial air-gap design for use on machine tools, roof-ventilating fans and other space-cramped applications. A cutaway drawing shows how the motors achieve their short length through formed-end coils and a one piece housing-bearing bracket.

★ ★ ★

Additional motor features are rugged cast iron construction, modern appearance, factory lubricated bearings, and quiet operation. They are made in ratings from 1 to 15 HP. Up to 1½ HP they are non-ventilated; above that, they are fan-cooled.

EXTRA COPIES OF THE BUYER'S GUIDE AVAILABLE FOR $5.00 EACH

CERAMIC TANKS ARE MAKING HEADWAY!



COVER HEATED galvanizing furnace for wire
(German and Foreign Patents issued)

Why?

- Unlimited pot life
- No penetration or erosion
- Less dross
- Low installation costs
- No zinc run-out channels
- Easy temperature control

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for
WIRE, HEXAGON NETTING STRIP, and PIECE GOODS

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Operation by Gas or Oil

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ALUMINUM INGOT AND MILL PRODUCTS AND MAGNESIUM MILL PRODUCTS: MARCH 1958

(Shipments and receipts are in thousands of pounds)

Item	Number of companies reporting shipments	March 1958			February 1958* net shipments	March 1957 net shipments
		Gross[1] shipments	Receipts[2]	Net[3] shipments		
ALUMINUM PIG AND INGOT, TOTAL	88	137,006	75,422	61,584	56,133	114,308
ALUMINUM MILL PRODUCTS, TOTAL	159	208,631	18,751	189,880	179,035	230,418
Sheet and plate, non-heat-treatable	28	84,730	14,511	70,219	65,970	77,358
Sheet and plate, heat-treatable	4	(D)	(D)	15,245	13,803	25,354
Foil, including foil in lamination	14	15,607	126	15,481	14,083	17,365
Rolled, and continuous cast, rod and bar[4]	5	8,576	3,322	5,254	4,671	10,874
Wire, bare, conductor and nonconductor	18	3,222	77	3,145	2,774	4,467
ACSR and aluminum cable, bare	11	(D)	(D)	13,831	14,196	15,778
Wire and cable, insulated or covered	14	(D)	(D)	3,286	3,497	3,879
Extruded shapes, soft alloys	97	46,547	608	45,939	44,788	50,945
Extruded shapes, hard alloys	9	3,871	...	3,871	2,883	6,212
Drawn tube, soft alloys	13	5,655	...	5,655	4,745	5,263
Drawn tube, hard alloys						
Welded tube, non-heat-treatable	8	(D)	(D)	[5]1,921	1,565	[5]3,980
Powder ans paste						
Atomized and grained powder	3	480	...	480	450	689
Flaked powder	5	249	...	249	348	383
Paste	5	804	...	804	813	1,117
Forgings (including impact extrusions)	17	4,500	...	4,500	4,449	6,754
MAGNESIUM MILL PRODUCTS, TOTAL	10	(D)	(D)	1,398	1,280	2,388

*Revised.

D Withheld to avoid disclosing figures of individual companies. These figures are included, however, in the appropriate total.

[1]Gross shipments of mill products represent total shipments by producers to customers, including other producers, and shipments by producers to their own fabricating departments which manufacture products beyond the level of mill shapes. Ingot gross shipments include shipments by importers.

[2]For mill products, represents receipts from domestic producers only. In addition to receipts from domestic producers, 91,000 pounds of mill shapes were received through imports. For ingot, receipts from imports are included.

[3]For mill products, derived by subtracting the sum of producer's domestic receipts of each mill shape from the industry's gross shipments of that shape. Ingot data derived by subtracting all receipts from shipments reported.

[4]Includes a small amount of rolled structural shapes.

[5]Includes a small amount of welded tube, heat-treatable.

ROLLER BEARING

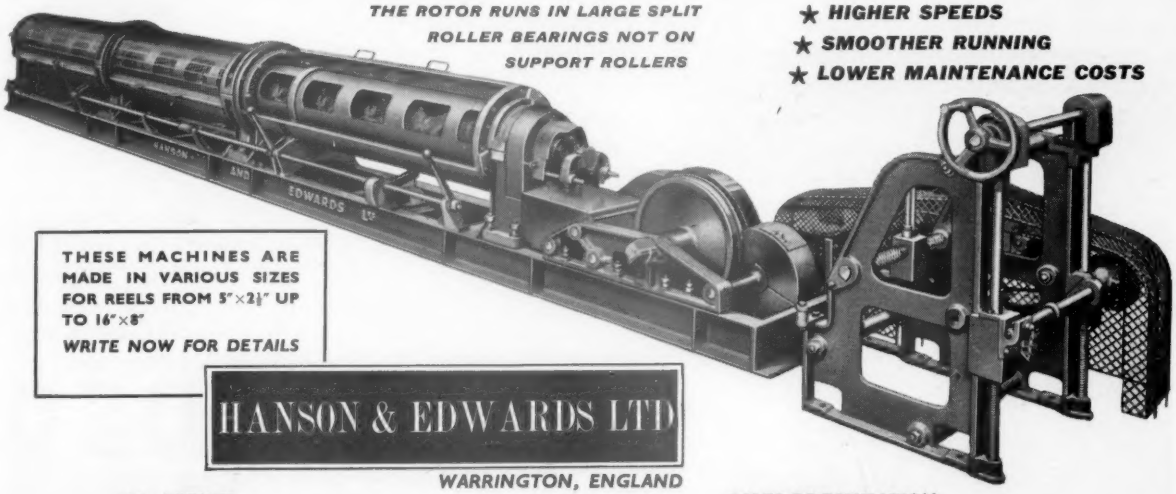
TYPE TUBULAR

STRANDING MACHINE

(EITHER SINGLE OR DOUBLE CAPSTAN)

THE ROTOR RUNS IN LARGE SPLIT ROLLER BEARINGS NOT ON SUPPORT ROLLERS

★ HIGHER SPEEDS
★ SMOOTHER RUNNING
★ LOWER MAINTENANCE COSTS



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AIS 10

Total Number of Companies Included 124

MARCH - 1958
Month

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

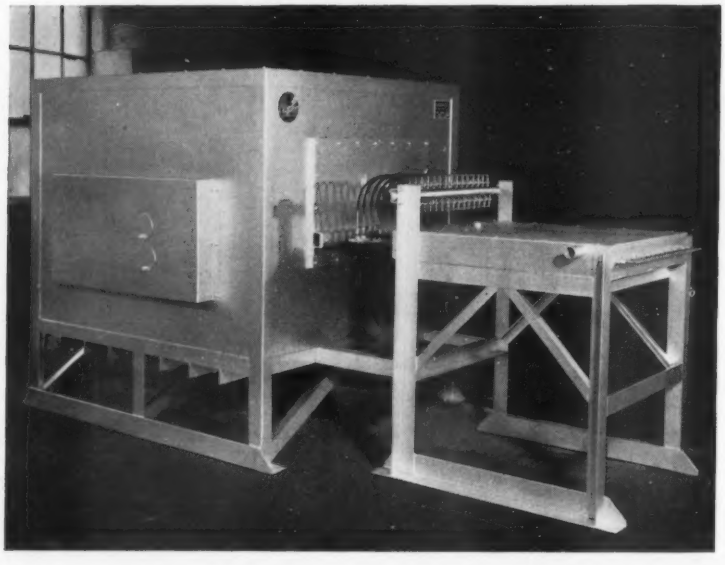
Steel Products	Items	CURRENT MONTH 1958 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1957) Percent of Total Shipments	YEAR TO DATE 1958 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1957) Percent of Total Shipments
Ingots and Steel Castings	1A	10,527	11,374	2,071	23,972	0.5	0.6	* 34,767	* 32,642	* 5,213	* 72,622	0.5	0.6
Blooms, slabs, billets, sheet bars	1B	82,819	23,201	1,319	107,339	2.4	3.6	240,336	71,995	3,448	314,879	2.3	3.0
Tube rounds	1C	443	260	2	705	-	0.1	1,382	624	2	2,008	-	0.1
Skelp	2	8,377	-	-	8,377	0.2	0.2	19,889	-	-	19,889	0.1	0.3
Wire rods	3	64,844	1,079	519	66,442	1.5	1.1	* 185,216	3,438	1,203	* 189,857	1.4	1.2
TOTAL SEMI-FINISHED		167,010	35,914	3,911	206,835	4.6	5.6	* 481,590	* 107,799	* 9,866	* 599,255	4.3	5.2
Structural shapes (heavy)	4	281,372	3,054	35	284,461	6.4	7.9	993,966	10,231	49	1,004,246	7.2	7.4
Steel piling	5	32,058	-	-	32,058	0.7	0.7	91,913	-	-	91,913	0.6	0.6
Plates	6	434,893	33,567	2,297	470,757	10.6	11.3	1,319,380	103,081	6,684	1,429,145	10.3	10.7
Bars—Hot rolled (incl. light shapes)	14	320,298	76,237	2,597	399,132	9.0	9.8	982,237	262,448	8,243	1,252,928	9.0	10.1
Bars—Reinforcing	15	141,130	-	-	141,130	3.2	3.1	365,933	-	-	365,933	2.6	3.1
Bars—Cold finished	16	65,179	10,813	3,529	79,521	1.8	1.6	199,135	34,112	10,069	243,316	1.8	1.7
Tool steel	17	727	5,068	-	5,795	0.1	0.1	2,158	15,815	-	17,973	0.1	0.1
TOTAL BARS AND TOOL STEEL		527,334	92,118	6,126	625,578	14.1	14.6	1,549,463	312,375	18,312	1,880,150	13.5	15.0
Wire—Drawn	23	174,104	2,419	1,698	178,221	4.0	3.0	* 500,193	8,584	4,922	* 513,699	3.7	3.1
Wire—Nails & staples	24	33,528	-	1	33,529	0.7	0.5	93,853	-	4	93,857	0.7	0.5
Wire—Barbed & twisted	25	6,860	-	-	6,860	0.2	0.1	16,060	-	-	16,060	0.1	0.1
Wire—Woven wire fence	26	18,414	-	-	18,414	0.4	0.3	47,455	-	-	47,455	0.3	0.3
Wire—Bale ties & baling wire	27	3,383	-	-	3,383	0.1	0.1	* 6,692	-	-	* 6,692	0.1	-
TOTAL WIRE & WIRE PRODUCTS		236,289	2,419	1,699	240,407	5.4	4.0	* 664,253	8,584	4,926	* 677,763	4.9	4.0
Sheets—Hot rolled	31	396,524	17,455	1,683	415,662	9.3	9.6	1,299,997	53,365	7,344	1,360,706	9.8	10.3
Sheets—Cold rolled	32	699,012	2,844	7,839	709,695	16.0	13.1	2,252,988	8,363	23,755	2,285,106	16.4	14.7
Sheets—Galvanized	33	195,885	-	-	195,885	4.4	2.6	550,161	-	-	550,161	3.9	2.9
Sheets—All other coated	34	12,570	-	-	12,570	0.3	0.2	41,074	-	-	41,074	0.3	0.2
Electrical sheets & strip	35	3,362	34,837	-	38,199	0.9	0.8	* 10,250	* 102,008	-	112,258	0.8	0.8
Strip—Hot rolled	36	71,319	1,435	450	73,204	1.6	1.7	216,439	4,068	* 1,809	* 222,316	1.6	1.9
Strip—Cold rolled	37	60,063	2,137	9,834	72,034	1.6	1.4	205,804	5,695	* 33,792	* 245,291	1.8	1.5
TOTAL SHEETS AND STRIP		1,438,735	58,708	19,806	1,517,249	34.1	29.4	* 4,576,713	* 173,499	66,700	4,816,912	34.6	32.3
TOTAL SHIPMENTS (1958)		4,153,606	259,566	35,354	4,448,526	100.0	xxx	*12,983,783	* 833,470	*111,422	* 13,928,675	100.0	xxx
TOTAL — PRIOR YEAR (1957)		7,307,091	452,870	61,655	7,821,616	xxx	100.0	21,143,705	1,359,904	186,172	22,689,781	xxx	100.0

*Revised

5258

HARPER STRAND ANNEALER

delivers bright stainless wire continuously at high speeds



Operating at temperatures from 2000°F. to 2200°F., this 30 tube Harper Electric Strand Annealing Furnace turns out Type 304SS wire bright and clean. Sizes from .02" to .0014" are passed through its 40" hot zone at rates up to 100 FPM per tube.

Providing close temperature control, Harper Strand Annealers maintain extremely dry reducing atmospheres to produce a truly bright finish. Designed for dependable, trouble-free performance over long periods, they permit wire speeds up to 150 FPM per tube.

Harper manufactures a full line of automatic conveyor, continuous tube, and bell type annealing furnaces for billets, bars, rods and wire. To solve your wire problem most profitably, call in a Harper engineer or write: Harper Electric Furnace Corporation, 42 River St., Buffalo 2, N.Y

HARPER
ELECTRIC FURNACES

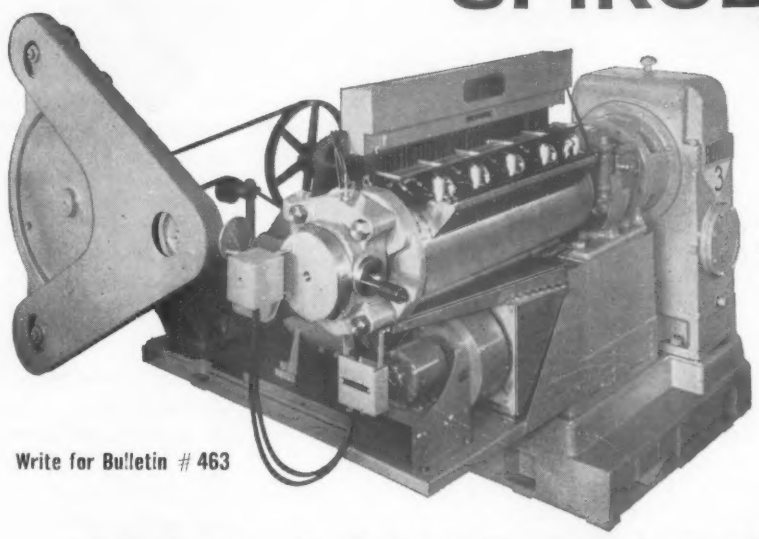
COPPER - Consumption of refined copper in the United States, February-March 1958, in short tons

	Wire mills 1/	Brass mills 2/	Chemical plants	Secondary copper smelters	Foundries and miscellaneous	Total
February:						
Cathodes	498	6,942	(3)	46	(3)	7,486
Wire bars	52,907	3,274	(3)	---	(3)	56,181
Ingots and ingot bars	823	4,314	(3)	98	(3)	5,235
Cakes and slabs	------	9,220	(3)	1	(3)	9,221
Billets	------	10,784	(3)	---	(3)	10,784
Other	83	------	(3)	19	(3)	102
Total	54,311	34,534	(4)	164	(4)	4/92,009
March:						
Cathodes	384	7,133	(3)	58	(3)	7,575
Wire bars	54,036	3,941	(3)	--	(3)	57,977
Ingots and ingot bars	1,042	4,051	(3)	240	(3)	5,333
Cakes and slabs	-----	7,596	(3)	1	(3)	7,597
Billets	-----	11,355	(3)	---	(3)	11,355
Other	69	------	(3)	38	(3)	107
Total	55,531	34,076	(4)	337	(4)	4/92,944

1/ Includes all wire mills with rod-rolling facilities. 2/ Includes all brass mills using copper in refinery shapes; some have rod-rolling facilities. 3/ Not available. 4/ Consumption by chemical plants, foundries, and miscellaneous plants not included. Estimate of 3,000 tons included in total.

ROYLE

SPIROD® for Rubber or Plastic Wire Insulating



Write for Bulletin # 463

These all electric extruders with radiant heat and high velocity evaporative cooling are designed to process either plastic or rubber compounds. The result of more than three quarters of a century of experience — Royle pioneered the extrusion process in 1880— in the design and construction of extruding machines time tested features have been built into Spirod to assure dependability.

JOHN ROYLE & SONS

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from your bar stock
and wire dies

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- BETTER WORKING CONDITIONS
- FASTER BUTT WELDING
- LONGER DIE LIFE
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Write to our Technical Department for further information

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Application Aspects of Wire Mesh Welding

(*Continued from page 762*)

Practically all welded mesh except that sold in flat sheets or mats is wound on a coiler or reel as a part of the continuous fabrication process. There has been a considerable evolution in reels since the first split arbor type manually tripped and manually loaded back into pivot bearings was first used.

★ ★ ★

One of the common type now used is the one piece mandrel which permits pushing the finished coil off one end. Sometimes a bearing retracts to permit this or the mandrel is pivoted on one end to leave the other end open.

★ ★ ★

Another type is the use of two solid mandrels that wind with abutting ends. Upon completion of the coil these two halves separate letting the coil drop free of the mandrels. This has a decided advantage in that each mandrel has to move only one half the distance of the coil width.

★ ★ ★

Regardless of the type of mandrel or arbor used, a most desirable improvement is to eliminate all resetting of the puller device on the reel. There are two new methods which eliminate this. The first of these is the use of two half length arbors that are slit their entire length. When they come together for winding position, there is a full length slot into which the leading edge of the coil is led and the turning of the arbor starts pulling the wire as the leading edge is bent over the outside radius of the mandrel. This is not unlike the old style split arbors first used in the industry which required manual resetting in the reel, but eliminates the manual handling and resetting of the arbor halves.

★ ★ ★

Another method is the incorporation of disappearing hook fingers that operate somewhat like a ratchet pawl. They hook on the

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"IT CORRECTS THE DIE"

automatic Polishing Machine

Double your finished Tungsten Carbide Die production

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The new automatic polisher with the Time Switch—

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The Standard of the Wire Industry

leading edge of the mesh as it comes to the coiler and then fold out of the way when the finished coil is stripped off the arbor.

★ ★ ★

The mesh welding industry is subject to the same economic pressures as all manufacturing industries; namely, the reduction of cost per unit of output. This means reducing the labor cost on each unit to a minimum. There is constant pressure on design to produce more mesh with less labor. One of the most important considerations in this vein is the continuous operation of the welding equipment.

★ ★ ★

Every effort is made to prevent the welder from any stoppage during a production turn. This means the continuous and automatic handling of the finished fabric both through the shear and on the coil. Proper control has now been devised that will permit the welders to operate continuously without stopping for shearing or unloading the finished coils. This may involve some type of looping pit or tower and on very high speed machines will require the use of two winding reels to keep up with the fabric welder.

★ ★ ★

It seems that there is a practical limit on speed for any given machine design and wire size over which it is not economical to operate. As machine designs increase in efficiency, this limit will be gradually raised. Since the welding time for a given wire size has a practical minimum time, and wire feed also, we feel that progress in this manner for producing at a greater speed is somewhat limited.

★ ★ ★

For the above reason, we feel that the next step to get really increased production is the method of increasing the number of transverse wires that are fed simultaneously. Our company has built a number of single wire machines just as others have.

★ ★ ★

We have also built a number of two wire feed machines.

★ ★ ★

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Pickling Bath Additives • Mold Lubricants • Corrosion Inhibitors

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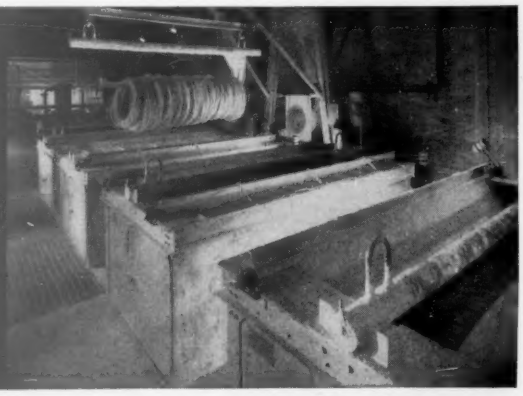

Faster baking, greater fuel economy, maximum production efficiency are just a few of the results of the exclusive heating arrangement of the Carl Mayer Hi-Speed Rod Baker. It also has a patented blow-off feature which removes moisture without damage to coils.

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INSULATING DIES AND NOZZLES
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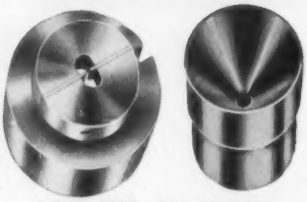
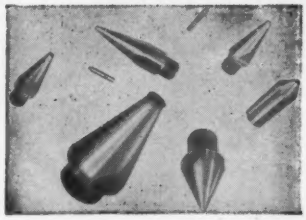


STEEL DIES—ALL SHAPES.



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BRIDGEPORT STEEL DIES are made in Round, Figure 8, Serrated, Tracer and other Special Shapes to your specifications. A newly designed Tru-Rip Die Assembly can be taken apart, cleaned, blades changed and reassembled quickly and easily. Made for 2 and 3 conductor wires to be coated in extrusion machines.

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SPECIALIZED ENGINEERING
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But for really high speed production, we have built a simultaneous four cross wire feed machine which at sixty strokes a minute on 6 x 6 mesh in #10 to #6 gauge will produce at the rate of 120 feet of mesh a minute.

* * *

The machine shown in the picture uses two winding reels combined with a looping pit. It also has a friction device that permits uniform winding tension on the reels. This device is also capable of driving a cut end from the looping pit, so it is independent of the welding machine. The only exception is the safety device that prevents the winding reels and friction rolls from pulling wire from the welding machine before it is welded and thereby losing register. Therefore, the welding machine can continue to operate continuously without stopping for shearing or coil ejection.

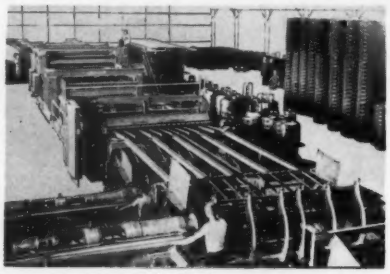

Figure 8—Picture—Four wire machine.

* * *

As mentioned previously, the high speed of this equipment necessitates using dead type pay off reels. This equipment uses 3000# coils and we feel it would be impossible to intermittently pull two feet at this rate of 60 strokes per minute without breaking wire or distorting the mesh pattern.

* * *

From a practical standpoint it is realized that the more transverse wires that are fed automatically the less versatile a machine will be for various patterns. We believe that the optimum setup for a manufacturer is not a group of machines that will weld the entire range of work desired but

rather equipment that can be set up efficiently to run a limited range of work at high speed. These would be used on the most popular sizes current in the industry. Some additional equipment should be used that is very versatile with a rapid changeover and for a wider range of work sizes.

★ ★ ★

Without trying to be facetious, I would like to outline the requirements for the ideal welded fabric machine:

a) Extremely high speed.
b) Operates continuously.
c) Practically no changeover time required.
d) Very accessible for maintenance.
e) Low maintenance.
f) Wide range of work capacity.
g) Little floor space required.
h) Minimum labor requirement.
i) Inexpensive price.
j) Very durable.

★ ★ ★

This machine may never be built, but at least it is something toward which to direct our efforts as a manufacturer and also for your process engineers to consider.

We take pleasure in announcing our appointment as United States agents for the

Hansen & Edwards Limited, Warrington, England,

ROLLER BEARING

TYPE TUBULAR

STRANDING MACHINES

MADE IN SIZES:
For Reels from 5" x 2½" up to 16" x 8",
having from 3 to 25 Bobbins.
Running at speeds from 2100 to 500 r.p.m.

THE STRANDER THAT RUNS IN ROLLER BEARINGS.

Write now for details.

THE EDMANDS CO. 860 Wellington Avenue Cranston 10, R. I.

Drawing and Insulating Wire in One Tandem Operation

(*Continued from page* 766)

reach the point at which it is being stretched. At a speed of 2,000 feet per minute, this would be about thirty-three feet from the annealer. If the indication is immediate, the trouble is undoubtedly located in the annealer itself.

★ ★ ★

Having successfully produced bare aluminum wire of good quality over the tandem system, the next step was to apply the plastic insulation. This introduced a new stretch point due to the drag in the extruder die which was being used at the time. Inasmuch as this was not related to tandemization, however, no attempt was made to correct the trouble during the limited time available. To confirm the conclusion that this difficulty was not related to tandemization, a small quantity of soft aluminum wire was insulated in the normal manner, bypassing the wire draw-

NON-RETURNABLE

REELS FOR MAGNET WIRE PACKAGING

HARDBOARD HEADS — PAPER DRUM
Sizes 12 x 6 x 6 and 12 x 7 x 6½ inches

- Holds up to 100 lbs. of wire.
- Higher impact strength — little breakage.
- Low in cost — no repairs or bookkeeping.
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- Every reel brand new — hence accurate and true.
- Produced to customers' specifications.
- Customers' labels can be applied.

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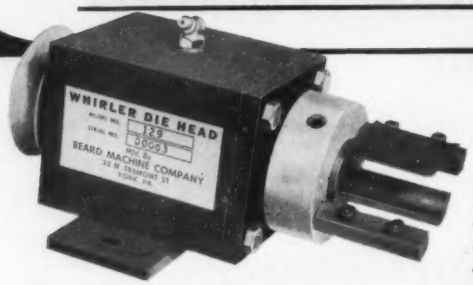

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Want uniform wire insulation of highest dependability . . . at lowest possible cost? Use modern Beard Whirler Heads and Dies in your asbestos insulating system. Beard dies are immediately available to accommodate more than 100 wire sizes. Can be used as wet whirlers and polishing heads, too. If you want flexibility, simplicity of operation, and big savings of time and labor — write for detailed data sheets and full information NOW!

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ing machine and annealer, with similar results.

★ ★ ★

The engineers now turned to the establishment of operating procedures for the production of copper wire on a routine basis by shop personnel. Operators having relatively short service and no experience with tandem operation were employed to run twenty-two gage and twenty-four gage insulated copper wire. With the exception of some interruption for experimental adjustments to determine optimum conditions, output during the remaining two days was comparable to that for conventional extruder line operation. This was accomplished in spite of the fact that provisions had not yet been made for transferring on the fly from one supply spool to the next —a common practice for conventional operation. This necessitated stopping and re-starting the line with each change of supply spool and was corrected a short time later.

★ ★ ★

In view of these favorable results, tandem operation will be used at the new Omaha cable plant. Fifty-five tandem lines are being installed, twelve of which will include the tinning process. The lines will reflect the Hawthorne and Montgomery experience by incorporation of power Selsyn drives and the features found most desirable in operating the two existing lines. By eliminating the need for wire drawing machine spoolers, a large number of spools, and associated handling equipment, the initial investment for facilities at Omaha will be reduced considerably. About 4,300 square feet of floor space was saved and the reduction in manufacturing costs amounts to several hundred thousand dollars annually.

★ ★ ★

This development is considered to be only one step of this kind of the inevitable march in the direction of automation and the automatic factory. To constitute sound progress, of course, each step must

be supported by lower costs, improved quality, or improved service to the ultimate customer. Tandemization as applied here is one such step.

Chromates as Applied to Hot Dip Zinc Coated Wire

(*Continued from page 769*)

which is laid down on the wire but also compensate for drag-out, as well as maintenance of the tri-hex ratio. As an example; a new bath started on Monday morning has a hex-chrome content of 4.8 gr/liter and a pH of 1.5. The frame is running 48 strands, three shifts per day for six days. The addition of concentrate is one gallon every two hours. At the end of the week the bath will contain approximately 8 gr/liter of hex, 1.0 to 1.1 gr/liter of tri and a pH of 1.6 to 1.75. Then the bath is dumped and a fresh one started the following week.

★ ★ ★

For additional protection the wire is passed through a wax tank following the chromate treatment. The nature of this wax is such that it is soluble in hot water, but insoluble in cold water. It is therefore easy to control the film thickness on the wire by controlling temperature and concentration in the wax tank. This wax not only offers added protection to the wire but has other functions as well. It is very effective as a lubricant in the fabricating process thereby helping to prevent the fracture of the chromate film. It also has a bearing on public relations, as it aids the "blockers" in "splitting off the frames." After some experience the blockers can determine the correct wax film thickness by how easily the wire slides off the blocks. In connection with this wax film there is one other factor to be considered. As stated earlier, when a chromate film is first formed on the wire, it is in a semi-gelatinous form. The curing of this film is retarded to some extent by this film of wax. It has been found that the protection is somewhat greater if the films are permitted to cure for approximately forty-eight hours prior to the wire being fabricated into fence.

★ ★ ★

It goes without saying that this combination chromate-wax film will not prevent white corrosion on hot dip zinc coated fencing for a lifetime; only the farmer would appreciate that. However, it will go a long way in the preventing of white corrosion during "shelf life". I personally have inspected chromate treated fencing that has been stored in the warehouse for eight to ten months, which was as bright and free from corrosion as it was the day it came off the frames.

Development of Aluminum-Clad Copper Wire

(*Continued from page 774*)

ter bare copper wire. Normal resistance of each of these wires is 5.100 ohms. These data were obtained by periodically measuring the resistivity of each of the two materials at room temperature be-

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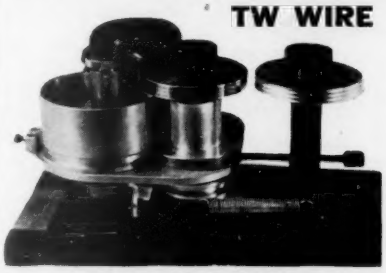

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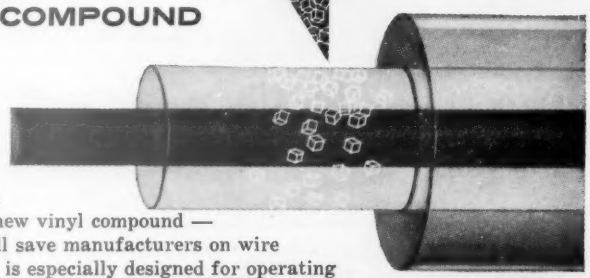

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fore and after aging. The permanent damage suffered by the conductors due to high-temperature aging in air is evident. All resistance calculations were based on original dimensions of the test wires.

* * *

Figure 3 and Table III show that the elevated-temperature resistance of the two materials tested are nearly, if not actually, identical and that a linear relationship, as expected, obtains between resistance gains and temperature.

* * *

Figure 4 illustrates the changes in surface texture, color, and size that occurred on aluminum-clad copper and copper wire during aging at indicated temperatures for a year. The aluminum-clad copper changes gradually from its normal bright appearance to a dull sheen at 300°C (572°F), a brittle dark grey at 400°C (752°F), and a black oxide at 500°C (932°F). Presumably sufficient diffusion has occurred here to bring copper to the surface to form black copper oxide. The copper wire, of course, oxidizes readily at 150°C (302°F) but does not flake off until 200°C (392°F) is reached. Size of the wire is progressively reduced as more and more oxide forms and flakes off.

* * *

Figure 5 shows a photograph of the polished cross-section of aluminum-clad copper wire at 100 diameters. The silver barrier layer can be seen as a lighter annular region around the copper core.

Summary

Some of the history of the development of aluminum-clad copper wire has been given along with recently obtained experimental results comparing this new wire with copper wire. Its useful service temperature range has been shown to be 100°C to 300°C. Aluminum-clad copper wire is meant to be only a first step in an overall program to develop satisfactory elevated-temperature conductors for the myriads of devices that require superior performance at elevated temperatures.

References

(1) A. S. Russell, Effect of Heating Aluminum and Copper Wires in Air Wire, March, 1952.

(2) E. T. Flynn, et. al., U. S. Pat. 2,700,212.

(3) C. L. Carlson, Aluminum-Clad Copper Magnet Wire for Elevated-Temperature Use, Elec. Mfg., June, 1957, p. 164-6; Elec. Mfg., Sept. 1957, p. 129.

Heavy Tinned Copper Wire for Electrical Conductors

(*Continued from page* 775)

stripping blades, properly designed coils, etc. These latter qualifications can be more fully explained by manufacturers of induction heating equipment.

* * *

Since heavy tinned stranded wire cannot be distinguished from commercially tinned strand, visually, particular care must be given to coding and identification.

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The following procedure is practiced by the Camden Wire Company. Heavy tin coated copper wire is put up on red "in process" spools. These spools of wire are lot tested according to quality control standards by use of the Kocour Thickness Tester. The wire is then stranded and put up on red shipping reels. A sample from each reel is bonded by induction heat and then attached to the reel, thus identifying the product up to the insulation process.

★ ★ ★

Compared to commercial tinning, heavy tin coating is in its infancy. We anticipate even further uses of heavy tin coated conductors and are presently engaged in further research and development.

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(*Continued from page* 779)

two other requirements in addition to the dominating factor—lowest possible cost.

H) Glass Sealing Properties

In electronic tubes, gas tightness is essential, as any possibility of leakage would be extremely detrimental to its life. For this purpose, conductor wires are required to seal with the base as one unit, so that there is no chance of any gas leakage. To supply this need, Sylvania manufactures Dumet, a Copper Clad No. 42 Alloy (containing approximately 42% nickel, balance iron) which is used quite extensively. Produced from .200" to .005" diameter, normally in the soft, bright condition, it is subsequently borated, welded to other wires as required and then mounted into the base of electronic tubes. Since the composite material has a thermal expansion almost equivalent to that of glass, gas leakage into the tube is eliminated.

★ ★ ★

Normal cladding techniques are employed. No. 42 Alloy rod is inserted into a copper tube, then processed by the successive reductions and anneals as described above. No. 52 Alloy Clad Copper is also produced to obtain glass sealing characteristics for use in the electronic industry.

I) Other Specialized Requirements

In a similar manner, wire may be fabricated for other uses—for example, as a high frequency conductor, wherein the skin effect is prevalent. Copper Clad Stainless Steel or Copper or Silver Plated Carbon Steels may be employed.

★ ★ ★

Fabrication of this clad material is achieved in the standard manner, down to the final required size.

Further Advanced Development

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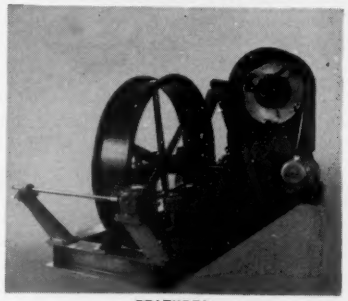

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tremely detrimental to the conductivity of metals, efforts are being made to insulate the core from the outside protective cladding. A number of materials are available for use depending on the requirements of the application and conditions of usage.

★ ★ ★

For other specific applications and requirements of usage not mentioned herein, the writer may be contacted for details.

Conclusions

In this brief analysis, a description of just a cross section of the various projects completed and under consideration has been attempted. Further developments for improved mechanical, electrical and other characteristics in the field of high temperatures, electrical conductors and electronics are being made with the progress of time.

★ ★ ★

It indicates that progress is an omnipresent dynamic necessity which must be constantly nurtured and fed through intensive research and development methods, an aggressive management and the best available equipment.

★ ★ ★

For any corporation there is nothing more discouraging than a lower priced or a better product in the hands of a competitor. Though healthy competition is essential to the advancement of a growing economy, it is still healthier to be ahead of your competition and just as important to be able to stay there.

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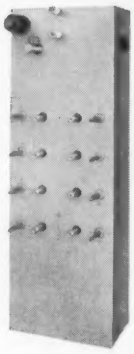

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The Buffalo Regional Meeting

(*Continued from page* 781)

place in the last two or three years that have done so much to place the mill on an efficient basis, productionwise.

★ ★ ★

One of the major improvements is electronically controlled United rod mill, which has increased the size of the rod bundles from 250 pounds to 620 or 630 pounds. The operation starts with 650 pound billets 30 feet long and 2 by 2½ inches in diameter. Rod enters the pouring reels at 6000 feet per minute. New wire drawing equipment was everywhere apparent, the principal output of the mill being wire of various grades from low to high carbon.

★ ★ ★

A point of considerable interest, sparked by Mr. Fisher's excellent paper on the subject, was the cross-wire welding shop, where welded fabrics for reinforcing purposes were being produced. Besides a number of welding units for smaller sizes, the mill contains one of the largest fabric-making welding machines in the country.

★ ★ ★

Another group took in the prearranged visit to the **Western Electric Company's** Buffalo plant,

with about 90 persons going through the mill. The activities of this plant cover a wide range of communication wire production, the chief point of interest being the newly developed combined drawing, annealing and insulating unit, which performs these functions in one continuous operation. Mr. Stoltz. of the Company's Hawthorne Works in Chicago, had described this set-up in a paper presented the day before. The tour was considered by those in attendance to be highly worthwhile.

Meeting of Electric Wire and Cable Section

At 2:10 o'clock the afternoon of May 2, all persons interested in the work of this Section met in the Statler Hotel to hear and discuss the plans for extending the service of the Association to this branch of the wire industry. **Hugo W. Biskeborn,** Chairman of the Electric Wire and Cable Organization Committee, presided.

★ ★ ★

Mr. Biskeborn outlined the work of the Committee to date, naming the men who were serving on it. The Section has two general divisions, one for bare and insulated power cables and one relating to communication wires, both concerned with the fabricating aspects of production. He detailed plans for the Annual Convention program that will make it a well-rounded series of sessions, in each of which papers will bear a relation one to another.

★ ★ ★

An active discussion followed, in which various ideas were put forth, one of which was not to pre-print papers prior to the Convention, as this is conducive to reduced attendance at the technical sessions. All suggestions were taken under advisement and the meeting adjourned at 3:20 o'clock in the afternoon.

The Program Committee

Responsible for the success of the Buffalo Regional Meeting was a group of very able gentlemen from Buffalo and nearby cities.

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These men secured the papers, arranged bus transportation, negotiated arrangements for the plant inspection tours, provided an outstandingly interesting after-dinner speaker and, in general handled many details, without which the meeting could not have proceeded smoothly.

★ ★ ★

This Committee consisted of:

FRED A. WEBBER, Chief Metallurgist (Chairman)
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Colorado Fuel and Iron Corp.
Buffalo, N. Y.

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ARTHUR J. POPKIN, Pres.
Paragon Wire and Cable Co.
Buffalo, N. Y.

★ ★ ★

Congratulations on a job well done! For the time and effort that these men put into the preliminary work, so necessary to the conduct of a worth-while meeting, the Officers and Directors of The Wire Association acknowledge and thank each one for the satisfying result that was achieved.

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★ ★ ★

Unlike older types of flat galvanized wire, the new Prentiss product is manufactured from round wire and coated with zinc while in round stages. As a result, the zinc coating is uniform around the entire circumference of the wire, assuring complete rust protection.

★ ★ ★

Coating round wire rather than strip has another important advantage, according to **J. R. Fuller,** manager of Prentiss Wire Mills. Since the slitting operation is not necessary in the Prentiss method, there is no danger of sharp corners being left on the wire, since the rounded edges of the new product assure smooth edges on the finished wire.

★ ★ ★

Coppered and tinned box stitching wire will continue to be produced at Prentiss because of the natural advantages offered by these finishes. The new galvanized wire will be recommended only for applications requiring a high rust resistance.

New Wire Cloth Manual

Available now from the **Michigan Wire Cloth Company** is its new "Engineer's Manual of Wire Cloth Strainer Design."

★ ★ ★

Full data is supplied in the manual as an aid to engineers responsible for the design or use of wire cloth strainers. The various grades of wire cloth are explained, with separate sections of the manual covering mesh and wire size and the types of materials generally available. It discusses weaves, meshes, metals, shape and construction, flow rate and fabrication processes.

The manual can be obtained from Michigan Wire Cloth Company, 2202 Howard, Detroit 16, Mich.

Bulletin on Design Service

Haveg Industries, Inc. of Wilmington, Del., announces a new design service for heat exchangers, falling film absorbers, towers, and chlorine coolers. Haveg now will do the process engineering, fabricate the equipment and guarantee performance to the customer's specifications. Speed of design and delivery is assured by Haveg's 32 field engineers who personally supervise each installation from a local district engineering office. Haveg maintains fabrication facilities at Marshallton, Del., West Warren, Mass., and Norwalk, Calif. A complete description of this service is given in Bulletin D-1. Address Haveg Industries, Inc., 900 Greenbank Rd., Wilmington 8, Del.

Heli-Coil Expanding Offices

Work has started at the **Heli-Coil Corporation,** Danbury, Conn., a Division of Topp Industries (Beverly Hills, Calif.), on a $75,000 expansion program for the renovation of administrative, research and engineering offices to a new air-conditioned area of more than 10,000 square feet within the existing building.

★ ★ ★

A portion of this new office area will be utilized to accommodate IBM data processing equipment valued at an additional $50,000 which will handle all sales order processing, market research and sales analysis data and inventory production and cost control.

★ ★ ★

According to **Leo J. Brancato,** Vice-President in Charge of Operations at Heli-Coil, the new facilities will mean improved engineering and customer service in keeping with the growth of the company. Mr. Brancato explained that several new developments on the basic Heli-Coil insert have been introduced during the past few years, and the principal insert markets have been expanded to include such major fields as electronics, machine tooling, hydraulics, construction, automotive and instrumentation.

Celebrates Silver Anniversary

National Electric Welding Machines Company, 1846 No. Trumbull St., Bay City, Mich., marked its twenty-fifth anniversary on June 2, 1958, by the issuance of a special brochure to commemorate this milestone of progress.

★ ★ ★

The brochure, entitled "Twenty-five Years of Progress — 1933-1958," includes a history of the company, biographies of the officers and principal executives, and illustrations and descriptions of the various types of welding equipment produced for today's industrial needs.

★ ★ ★

National is known in the wire industry for its excellent wire mesh welding machines for producing mesh for reinforcing purposes.

★ ★ ★

Those interested in receiving a copy of the brochure may secure one by writing on company letterhead for one.

Sheffield to get New Rod Mill

The Sheffield Division of **Armco Steel Corporation** has started work on a new 10 million dollar rod mill at Kansas City, Mo., which has been designed to be one of the fastest 10-inch rod mills in the world.

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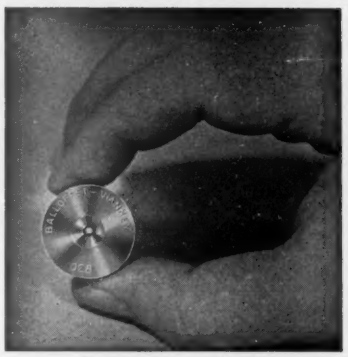

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It will have a 6000 foot per minute finishing speed and a production rate of 80 to 90 tons per hour on bars. The new mill is being constructed by the Rust Engineering Company of Pittsburgh, Pa.

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Wire and Textile Machinery, Inc. Announces Western Subsidiary

Harold Kenner, President of **Wire and Textile Machinery, Inc.,** has announced the formation of a subsidiary to serve the Electrical Wire and Cable and Wire Rope Industries west of the Mississippi and the Pacific Export Area.

★ ★ ★

The new firm, to be known as **Western Wire and Textile Machinery, Inc.,** is located directly across the Freeway from the San Francisco International Airport, at 230 Shaw Road, South San Francisco.

★ ★ ★

The parent company, Wire and Textile Machinery, Inc., of Pawtucket, Rhode Island, has been supplying used Wire and Allied Equipment to the Wire Rope and Electrical Wire and Cable Industries for the past twenty years. Mr. Kenner stated that the increased demand for Wire Equipment in the West as well as in the Pacific Area made the establishment of a Western Division mandatory in order to properly serve the Industry there.

★ ★ ★

Paul I. Kenner, who has held positions within the Wire Industry for the past twenty years, will act as President of the new subsidiary, residing in San Francisco.

★ ★ ★

Western Wire and Textile Machinery, Inc. occupies a new, modern warehouse building with complete truck and rail facilities and the latest material handling devices which will enable it to offer the very best service to the Western Wire Industry.

★ ★ ★

The new subsidiary plans to cover the entire Western portion of the United States, Western Canada, Mexico and the Pacific Export Area and will warehouse a complete line of Used Wire Rope and Electrical Wire and Cable and allied Equipment.

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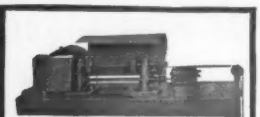
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Brochure on Microscopes

Ernest F. Fullam, Inc., P.O. Box 444, Schenectady 1, N. Y., has announced the availability of a new brochure covering industrial microscopes and accessories. Copies of this publication are available upon request to the company.

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Translated from item in Draht-Welt, April, 1958.

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Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES DIAMOND—Drawing Angle Controlled
Hoosier Wire Die, Inc., Ft. Wayne, Ind.

DIES DIAMOND—Reversible
National Wire Die Co., Inc., New York, N. Y.

DIES—Extrusion
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Kelloy Corporation, New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Polishing, Asbestos Wire
Beard Machine Co., York, Pa.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Metallurgical Products Dept. of General Electric Co., Detroit
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Hoosier Wire Die., Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Electric, Adjustable Speed
Allis, The Louis Co., Milwaukee, Wisc.

DRUMS—Wire Packaging
Continental Can Company, Van Wert, Ohio
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FREQUENCY CHANGERS—
The Louis Allis Company, Milwaukee, Wisc.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Galvanizing Equipment
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Company, Philadelphia, Pa.
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Resistance Heating, Strand
Electric Furnace Company, Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio

FURNACES—Strand Annealing
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Company, Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GEARMOTORS—
The Louis Allis Company, Milwaukee, Wisc.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—For Wire
Burlington Fabricators Inc., Products Div., Burlington, N. J.
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Chemical Products Corporation, East Providence, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS —
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Shawinigan Resins Corporation, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

LACQUERING SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The. Philadelphia and Bellefonte, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Company, Harrison, N. J.
Rome Soap Mfg. Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.

MACHINERY—Bobbin Winders
Hanson & Edwards, Ltd., Warrington, England
Larmuth and Bulmer, Limited, Manchester, England

MACHINERY—Bolt, Rivet, Screw, etc.
Behr Machinery & Equipment Corp., Rockford, Ill.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Providence, R. I., Division of Wanskuck Co.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The. Cranston, R. I.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corporation, New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England

MACHINERY—Chain Making
Baird Machine Company, Stratford, Conn.
Larmuth and Bulmer, Limited, Manchester, England
Nilson, A. H. Machine Co., Shelton, Conn.
Pan American Supply Co., The, New York, N. Y.

MACHINERY—Closing Rope
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Behr Machinery & Equipment Corp., Rockford, Ill.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Herborn, Maschinenfabrik, Herborn, Germany
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden.
National Mach'y Exch (Used), New York
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Pan American Supply Co., The, New York, N. Y.
Patterson Machine, Geo. C., Co., Cleveland, Ohio

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Company, Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Maschinenfabrik, Herborn, Germany
Wheelabrator Corporation, Mishawaka, Indiana

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Detroit
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

WHERE TO BUY, Continued

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming Wire
Baird Machine Company, Stratford, Conn.
Nilson, A. H. Machine Co., Shelton, Conn.

MACHINERY—Galvanizing Wire
Vaughn Machinery Co., Cuyahoga Falls, O.
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Mfg. Co., Wallingford, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Hydraulic
Porter, Inc., H. K., Somerville, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Beard Machine Co., York, Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia
Cook Mfg. Co., The, Paterson, N. J.
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Godderidge Ste., Houilles (Seine-et-Oise), France
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Patenting Wire
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Plating
Hodge Bros. Machine Shop, Ossining, N. Y.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York,
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Polishing Asbestos Wire
Beard Machine Co., York, Pa.

MACHINERY—Printing on Electric Wire
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M. Co., Inc., Boylston, Mass.

MACHINERY—Re-Spooling
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Colbourne Machine Company, Winsted, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Industrial Winding Machinery Co., New York, N. Y.
National Mach'y Exch. (Used), New York N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Peschel Electronics, Inc., New Rochelle, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Co., The, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Staple
Baird Machine Company, Stratford, Conn.
Nilson, A. H. Machine Co., Shelton, Conn.
Pan American Supply Co., The, New York, N. Y.

MACHINERY—Straightening & Cutting
American Laubscher Corporation, New York 19, N. Y.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Co., The, New York, N. Y.
Patterson Machine, Geo. C., Co., Cleveland, Ohio
Porter, Inc., H. K., Somerville, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Godderidge Ste., Houilles, (Seine-et-Oise), France
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth & Bulmer Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Foundry & Machine Co., Waterbury. Conn.

MACHINERY—Take-Up and Pay-Out
American Insulating Mach'y Co., Phila., Pa.
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Colbourne Machine Company, Winsted, Conn.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf. Germany
Larmuth & Bulmer Limited, Manchester, England
Litzler, C. A., Co., Inc., Cleveland, Ohio
Pourtier Pere et Fils, Romainville (Seine) France
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Federal Mfg. Co., Wallingford, Conn.
Peschel Electronics, Inc., New Rochelle, N. Y.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Godderidge Ste., Houilles (Seine-et-Oise), France
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—Welded Wire Mesh
National Electric Welding Machines Co., Bay City, Michigan

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery —Welding Wire Fabrics)

MACHINERY—Winding Wire
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle, James L., Esmond, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Industrial Winding Machinery Co., New York, N. Y.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York 19, N. Y.
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Federal Mfg. Co., Wallingford, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Pan American Supply Co., The, New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wartenweiler, Emilio, Milan, Italy
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Wire Forming
Baird Machine Company, Stratford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Shelton, Conn.
Pan American Supply Co., The, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Larmuth (1947) Ltd., Swinton, England

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MOTORS—Electric, A.C. — D.C.
The Louis Allis Company, Milwaukee, Wisc.

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Company, Winsted, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAINT BONDING CHEMICALS—
Amchem Products, Inc., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAPER—Creped Wrapping
Ludlow Papers, Inc., Needham Heights, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Ludlow Papers, Inc., Needham Heights, Mass.

PAPER—Insulating
Ludlow Papers, Inc., Needham Heights, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

PATENT—ATTORNEYS—
Rommel, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Monsanto Chemical Company, Plastics Division, St. Louis, Mo.

PLASTICS—for Wire Insulation
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Shawinigan Resins Corporation, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

PRINTING WHEELS—for Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M. Co., Inc. Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

RACKS—Wire Storage
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Mettler Machine Tool, Inc., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
National Vulcanized Fibre Co.. Lestershire Spool Div., Johnson City, N. Y.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
National Vulcanized Fibre Co.. Lestershire Spool Div., Johnson City, N. Y.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Evans, George, Corp., Moline, Ill.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
National Vulcanized Fibre Co.. Lestershire Spool Div., Johnson City, N. Y.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Steel, for Rope and Cable
Evans, George, Corp., Moline, Ill.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Boonton Molding Company, Boonton, N. J.
Bridge Mfg. Co., The, Hazardville, Conn.
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River. Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William. Westport, Mass.
Molded Fibre Glass Tray Co., Linesville, Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
National Vulcanized Fibre Co.. Lestershire Spool Div., Johnson City, N. Y.
Nilson, A. H. Machine Co., Shelton, Conn.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Pittsburgh Steel Co., Pittsburgh, Pa.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SATURATION SYSTEMS—
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—Plastic
Boonton Molding Company, Boonton, N. J.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Molded Fibre Glass Tray Co., Linesville, Pa.
National Vulcanized Fibre Co.. Lestershire Spool Div., Johnson City, N. Y.
Standard Mill Supply, Co., Pawtucket, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS
Jarke Manufacturing Co., Chicago, Illinois

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TABLES—Press Feeding

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H., Hagen i.W., W. Germany.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TESTERS—INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TOOLS—Wire Cutting
Porter, H. K., Inc., Somerville, Mass.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Hodge Bros. Machine Shop, Ossining, N. Y.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Shawinigan Resins Corporation, Springfield, Mass.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila, Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
Micro Products Co., Chicago, Ill.
National Electric Welding Machines Co., Bay City, Michigan

WHEELS—for Printing on Electric Wire
Gem Gravure Company, West Hanover, Mass.

WIRE—Aluminum
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Clad and Plated
Sylvania Electric Products Inc., Warren, Pennsylvania

WIRE—Cold Heading
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Montgomery Co., The, Windsor Locks, Conn.
National Standard Company, Niles, Mich.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corporation, Pressed Steel Div., Cleveland, Ohio
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Metalizing
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Worcester Wire Works Div., National-Standard Company, Worcester, Mass.

WIRE—Needle
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Special Shapes
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Continental Steel Corp., Kokomo, Ind.
National Lock Washer Company, The, Newark, N. J.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Roebling's John A., Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Firth Sterling, Inc., Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE AND MASTICATING MACHINERY MANUFACTURERS

WATSON

PLANETARY STRANDERS. Three types, many sizes, for all duties, geared or ring backturn, main rotor shaft or roller support. "Shaftless" cradles.

RIGID FRAME STRANDERS "RH." Horizontal, overhung spindle designs. Ball bearing main rotor shaft support, no support rollers.

TUBULAR STRANDERS "TH." High speed type in all sizes. Patented Boat cradles and Tungsten Carbide guide system. Rotor and layhead electric stops.

TUBULAR STRANDERS "VL." New design, safe extra high speeds. Quick loading. "Shaftless" no loose parts cradles.

CABLERS.

Planetary and high speed "HH" designs.

CLOSERS.

Planetary, Rigid Frame and High Speed Types for Wire Rope and Electric Cables.

WATSON

BUNCHERS.

VERTICAL
Minimum Floor Space
Double-Twist Types
"V-7"
250 # Cap.
V-10
500 & 1000 # Cap.

ARMORING MACHINES. Complete with planetary wire or metal tape heads.

JUTERS. 36 or 48 cop and to 6-inch cable passage.

SERVING HEADS. Concentric and eccentric, many designs, for threads, asbestos, etc.

TAPING HEADS. Many types and sizes. For metallic and non-metallic tapes. Eccentric, single and double-concentric. Patented uniform torque tape brake.

COMPOUNDING AND SATURATING TANKS. Many types and sizes.

CHALK, MICA AND OTHER POWDER APPLIERS. "Wet and Dry" types in a variety of designs and sizes.

CAPSTAN SECTIONS. Single tapered wheels to 10 foot dia. with standard single or double shoe, or ball bearing ring fleeters. Double grooved types to 96 inch dia. For heaviest duty and highest haul pulls. Many sizes and designs.

TRACTOR CAPSTANS. Available in two types with sizes to suit many applications.

LET-OFF. Manual, mechanical, hydraulic, and electric motor lift types and "shaftless" designs to 120-inch 30-ton sizes.

GANG SPOOLERS. Table and Floor types in many sizes and designs.

REWINDERS AND COILERS. All motorized, for warehouse and shipping use.

CAPSTAN TAKEUPS. Single and in multiples.

HEAVY DUTY TAKEUPS. "Shaftless" in many designs and sizes to 120"-30-ton. Mechanical lift, hydraulic lift, motorized lift, incline frame, and other types. Line shaft, electric, and hydraulic drives. Foot treadle, electric switch, pneumatic, hydraulic, and mechanical controls.

CONTINUOUS TAKEUPS. Double reel designs, constant tension, wide speed range to cover all Continuous Vulcanizing and plastic Extruding takeup requirements.

TAKEUP TRANSMISSIONS. Heavy Duty, Type "D." Combines two-speed transmission, manual slack-takeup drive, and multiple-disc-in-oil friction mechanism in one compact unit. Now available in two sizes.

AUTOMATIC TRAVERSES. Many sizes and arrangements. Wide lay range. Designs cover range from fine wire to 6" cable and wire rope. Fully automatic and disconnectible for manual operation. Suitable and widely used for replacement of inadequate mechanism on older takeups.

VULCANIZERS. Cavity and Plate "Patch" units. Mechanically or pneumatically operated. Available with or without dies.

MOLDED SHEAVES. Low cost, light weight Bakelite sheaves 11" O.Dia. x 8" groove Dia. Available in a variety of colors.

TESTING MACHINES. Impact, Torsion, Bend and Endurance types.

MEASURING MACHINES. For linear measurement. Offered in a variety of sizes and arrangements.

REEL CRUTCHES. For turning very large and heavy reels. Widely used in warehouses, shipping rooms, by railroads, steamship lines and wherever reel handling is a problem. Available from stock.

CABLE PLANT AND WIRE ROPE MILL EQUIPMENT. All manners of special and miscellaneous designs for general and special purpose work too numerous for listing but on which inquiries are invited.

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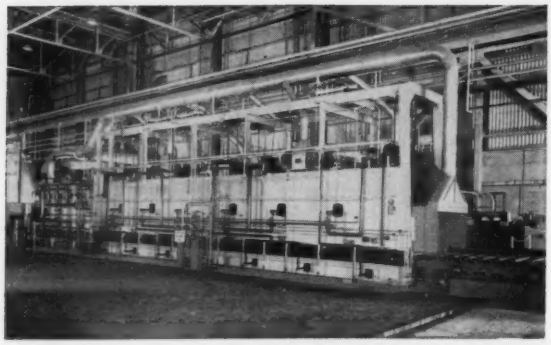
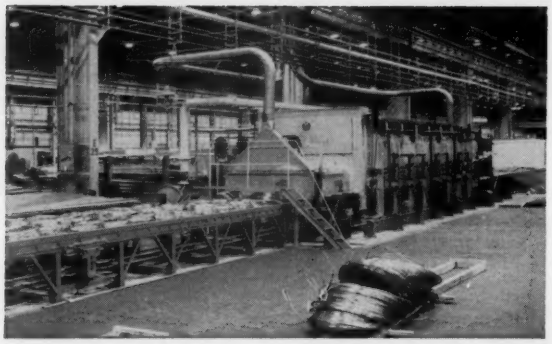
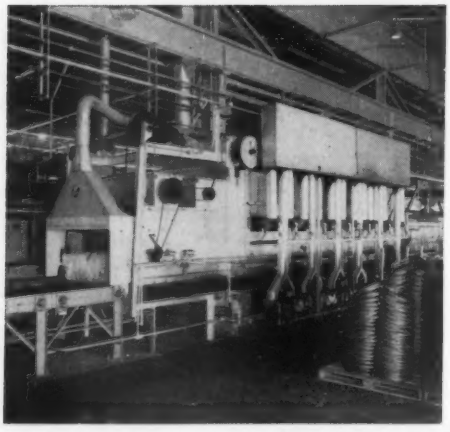


This EF twin-chamber multi-purpose direct gas fired roller hearth forced circulation furnace uniformly anneals coils of copper or brass strip—operates either intermittently or continuously.



EF direct gas fired forced circulation roller hearth furnace for process and finish annealing copper and copper alloy tubing and rod in coils and straight lengths—also handles coils of wire.

EF *congratulates* A.B. *on opening new plant in* L.A.



Another EF multi-purpose gas fired radiant tube, forced circulation roller hearth furnace used for bright finish annealing coils or straight lengths of copper tubing; also coils of thin gauge copper strip.

The new plant of The American Brass Co. at Los Angeles—the West Coast's newest and largest brass mill—incorporates only the most modern methods and plant equipment for producing copper and brass strip, tubing, rod and other forms of commercial brass, copper and copper alloy mill products.

This progressive step in the Company's extensive and continuous modernization program and the strategic location of this new plant makes possible the economical production of large quantities of copper and brass products of the highest quality, standards of precision and uniformity, and provides the means for rendering even better service to their customers.

Long experience and the high standards of EF design contributed to the selection of The Electric Furnace Co. as the designers and builders of the furnaces required for this modern plant.

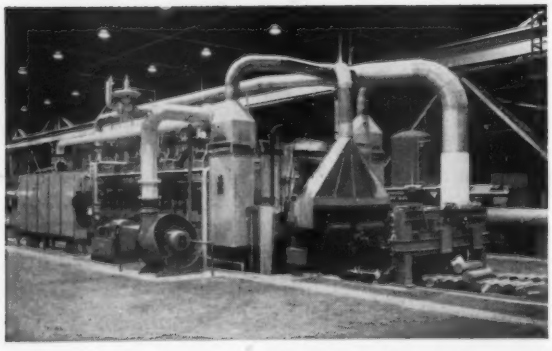
Submit your production furnace problems to experienced EF engineers — it pays.

THE ELECTRIC FURNACE CO.

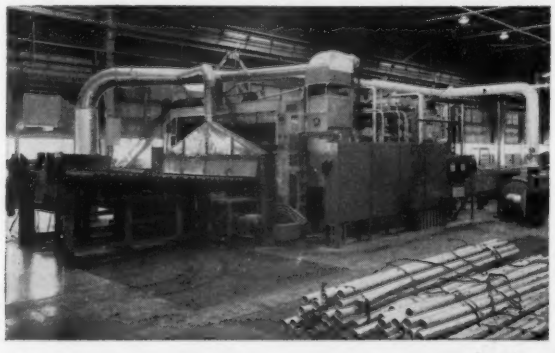
GAS FIRED OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem - Ohio

Canadian Associates • CANEFCO LIMITED • Toronto 13, Canada



An EF direct gas fired, 2 row, chain strand conveyor furnace for heating copper alloy billets for extrusion.



This EF direct gas fired, 2 row, screw conveyor furnace heats copper and copper alloy billets for piercing.